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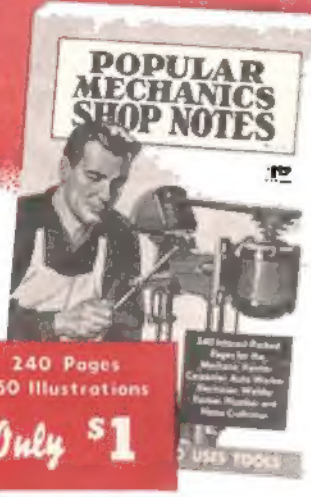

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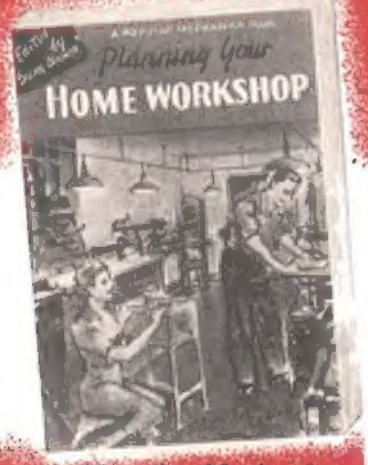

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Fastening WHEELS TO SHAFTS

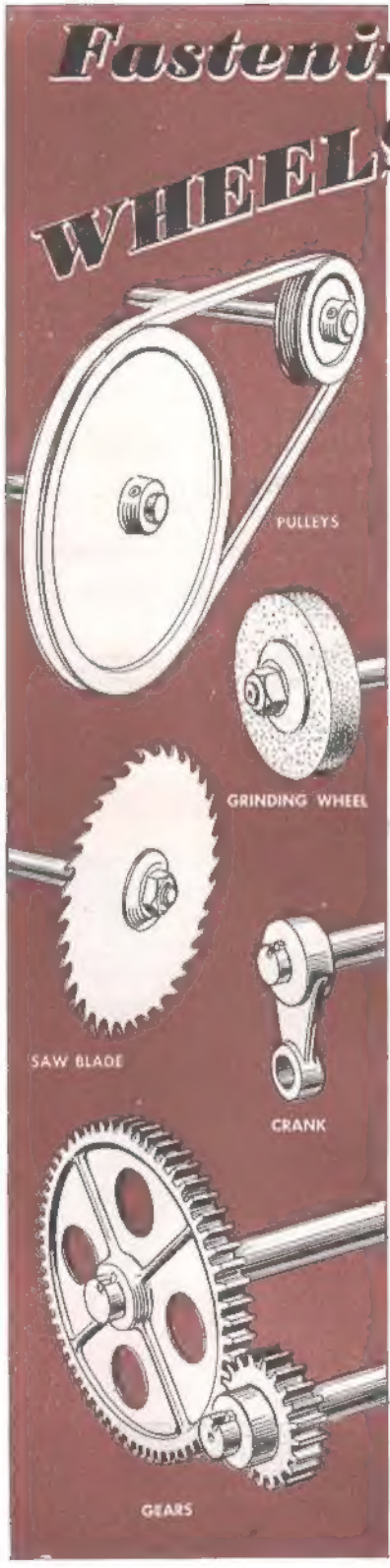
Pulleys, gears and clutches transmit power from one machine part to another, but only the fasteners prevent the wheels from spinning idly

By W. S. Kals

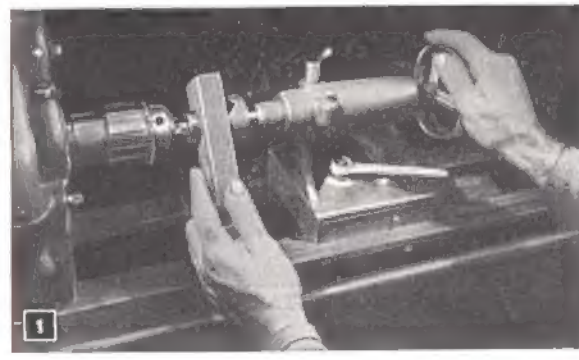
IN DESIGNING or building homemade power-driven equipment and in attaching new gears, pulleys, wheels or clutches to machine units, methods of fastening these parts are governed by the size of the parts and the force, or torque, to be transmitted. The fastener must withstand pressures developed by the sustained load, or turning force, plus shock loads originating within the mechanism, and also must resist any lateral forces that may act on the rotating parts.

Some fasteners take care of these requirements in one application, but others require separate provisions for transmitting torque and for taking up lateral thrusts. Separate fasteners are of several types. These range from a simple nail or cotter pin to straight and taper transverse pins, which pass through the wheel hub. They also include setscrews, Figs. 9 and 11, and keys of various shapes and applications. In addition, there are the force-fit, shrink-fit and expansion-fit types of fastening in which the parts are simply forced together cold, or one or the other of the parts is cooled or heated.

Force fit: This is a common method of fastening where a smooth hub contour with no projecting keys or pins is required and where the sustained load is uniform with no possibility of shock. On very light work where turning forces are small and accuracy is of secondary importance, such as the gear in Fig. 2, dimpling the shaft or hub of the gear with light blows from a ball-peen hammer will provide sufficient friction between the hub and the shaft to carry the load and prevent any lateral movement of



Any lathe can be used as a light arbor press suitable for pressing small parts onto shafts. The shaft is held in drill chuck



Force fits for small gears and other parts attached to standard shafting are achieved by simply knurling the shaft. The knurl has the effect of increasing the diameter of standard shafting as much as .003 in.

the gear. An arbor press is commonly used to force the gear on the shaft. When installing gears, pulleys or other parts carrying heavier loads, the shaft is made slightly larger than the diameter of the hole in the wheel hub. A common rule of thumb is to allow .001 in. for each inch of shaft diameter. Fig. 3 shows one method of achieving a force fit by simply knurling the end of the shaft in a lathe. The effective diameter of the shaft for purposes of a force fit may be increased as much as .003 in. in this manner. However, if the shaft or the wheel hub is of soft metal, the tips of the knurl either will flatten to some degree or bite into the hub. In this case, the effective diameter will be reduced. This method often is used where it is necessary to force-fit a wheel onto a shaft of exactly the same diameter as the hole in the hub. It is employed also in fitting parts onto cold-rolled-steel shafting which may run slightly undersize. Usually the knurl will provide the extra .002 in. needed for a force fit. A lathe can be made to serve as an arbor press for small parts by setting it up as in Fig. 1. Here the shaft is chucked and the fitting, in this case a small ball bearing, is started on the shaft by hand. Then the tailstock is brought up and a block of hardwood is placed between a crotch center and the bearing. It is possible to force-fit small parts in this manner with practically no distortion.

Shrink fit: Where the parts are fairly large and carry much heavier loads, some form of shrink fit is used. In some cases, a part can be heated sufficiently by immersing it in boiling water. Oil, which has a higher boiling point than water, gives a slightly greater expansion. Where the wheel is large and it is impractical to heat in this manner, the shaft can be shrunk by cooling. In ordinary work, the result will be the same.

5 TABLE

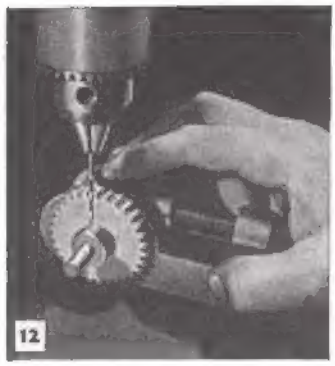
Shrink-Fit: obtained by heating outer member
Expansion-Fit: obtained by cooling inner member
Compound-Fit: obtained by heating outer member and cooling inner member

Rule of thumb:
Interference needed, .001" per in. dia. of shaft.
Table gives the change per in. dia.

Material	Dry Ice	Boiling Water
Aluminum	— .0020	+ .0017
Brass	— .0017	+ .0015
Copper	— .0015	+ .0012
Cast Iron	— .0010	+ .0008
Steel	— .0011	+ .0009

9 TABLE

Shaft Dia. (Inches)	Setscrew To Use
Up to ¼	No. 8 - 32
5/16 - 3/8	No. 10 - 24
½ - 11/16	¼ - 20
¾ - 15/16	5/16 - 18
1 - 1¼	3/8 - 16



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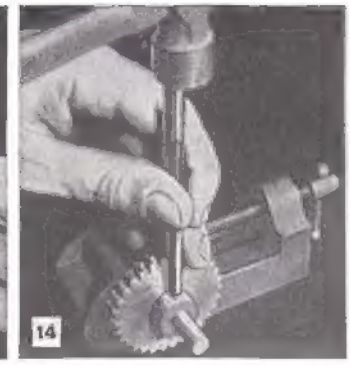

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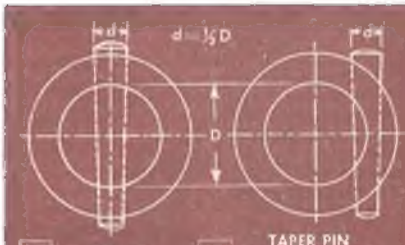
Small gear wheels to be fitted with setscrews are drilled and tapped as in Figs. 12 and 13. When seating a taper pin in the hub of a wheel, use a pin punch and tap it lightly, otherwise the pin may "freeze"



15 TAPER PIN

16 TAPER PIN SET OFF CENTER

17 TABLE

Shaft Dia. (Inches)	Pin Number	Large End Dia.	Approx. Fraction of In.
3/16	7/0	.062	1/16
1/4	5/0	.092	3/32
5/16	3/0	.125	1/8
1/2	0	.156	5/32
9/16	2	.193	3/16
3/4	4	.250	1/4
1	6	.341	11/32
1 1/2	8	.492	1/2
2 1/2	10	.706	23/32

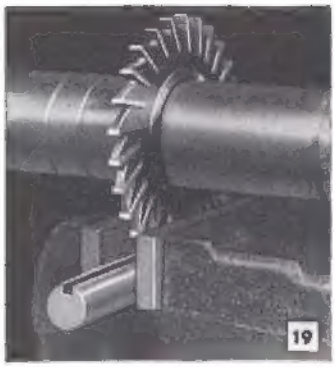
TAPER REAMER

18 TABLE

Code Number	Small Dia.	Large Dia.	Smallest Drill
7/0	.045	.067	56
6/0	.061	.081	52
5/0	.072	.097	49
4/0	.087	.114	43
3/0	.103	.130	37
2/0	.114	.146	32
0	.129	.164	29
1	.145	.180	26
2	.161	.201	20
3	.181	.229	14
4	.207	.260	4
5	.241	.299	C
6	.278	.354	K
7	.330	.422	R
8	.397	.505	X
9	.481	.607	31/64
10	.580	.721	37/64

Expansion fit: In expansion fitting, the shaft is cooled so that it will fit into the hole in the hub. Solidified carbon dioxide (Dry Ice) provides a cheap and practical way of cooling a shaft for an expansion fit. (Caution: do not touch carbon dioxide with the bare hands.) As a rule, allowing work to remain packed in carbon dioxide for 10 to 15 min. will give sufficient shrinkage. The table in Fig. 5 shows the expansion and shrinkage values for several common metals. As an example in calculating the necessary shrinkage or expansion required, take a brass gear wheel with a bore of 2 in., the wheel to be shrink-fitted to a steel shaft. By the common rule, the required diameter of the shaft would be 2.002 in. By heating the gear in boiling water it would normally expand 2 X .0015, or .003 in. When heated, the bore of the gear wheel would measure 2.003 in. and should slip over the end of the shaft quite easily. By chilling the shaft in carbon dioxide, it is reduced 2 X .0011, or .0022. The diameter of the shaft then would be 1.9998. In cases where expansion or shrinkage of one of the parts is insufficient, the compound fit is used. The compound fit is accomplished as stated in Fig. 5, by heating the outer, or female member, and cooling the inner, or male member. This method also is used frequently in high-grade work.

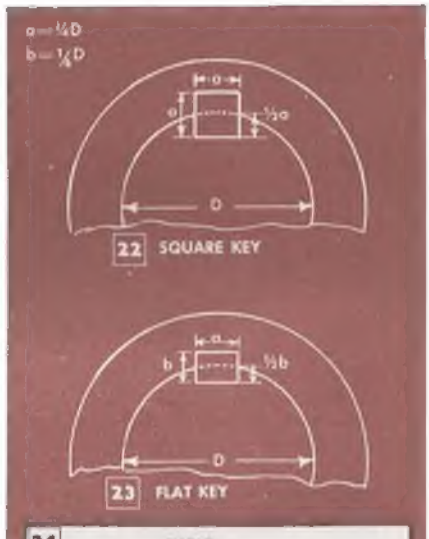
Pin fastenings: The simplest of these are the bent nail and the cotter pin or key, Figs. 6 and 7. For slow driving speeds and light loads, these fasteners serve the purpose as they will transmit power on slow drives and also prevent the wheel moving laterally on the shaft. They do not, however, withstand shock loads or heavy thrust. Elaborations of the pin fastening are the off-center screw, Fig. 8, and the threaded key, which is turned into a hole tapped half in the shaft and half in the wheel hub as in Fig. 10. Socket-headed setscrews with flat and cup points are used to fasten machine pulleys, particularly pulleys on small motors. Small gear wheels on experimental equipment often are provided with this type of fastening as the wheels are removed easily when gear ratios must be changed. The wheel hubs are drilled and tapped for the screws as in Figs. 12 and 13. On small-diameter shafts, such as



Keyways for both flat and square keys are milled in the shaft. By boring the hub of the wheel oversize and silver-soldering a slotted sleeve in the bore as in Fig. 21, the internal keyway is formed without milling

those on most motors of less than ½ hp., the setscrew seats on a flat milled on the shaft. A flat also can be ground on a shaft as in Fig. 4. Pulleys and other driving and driven wheels attached to the shaft with a square key or a flat key, Figs. 22 and 23, usually are provided with a setscrew, which is tightened on the key to hold it in place and also to prevent the wheel from moving laterally on the shaft. Figs. 15 and 16 and the table in Fig. 17 show two applications of the taper-pin fastener. This method of attachment gives the rigidity of the shrink and expansion fit but permits removal of the wheel by simply driving out the pin. Holes for taper-pin fastenings first are drilled with an ordinary twist drill of the required size and then reamed with a taper reamer. Fig. 18 lists the common sizes of small taper reamers and gives the drill sizes to use. Where the parts are not subjected to severe vibrations the taper pin is set lightly in the wheel hub with a pin punch as in Fig. 14.

Key fasteners: On drives which are subjected to variations in load and where the parts are too large to make pinning practical, wheels are keyed to the shafts. The driving and driven members of various types of clutches on stationary equipment often are fastened to the shafts in this manner. The square and flat keys, Figs. 22 and 23 and the Woodruff, or half-moon key, Fig. 25, are commonly used. Sizes of these keys have been standardized and the tables in Figs. 24 and 25 list common sizes. The position of the key with relation to the wheel hub and shaft has been more or less standardized also, as indicated by the key letters "a" and "b" in Figs. 22 and 23, and the letters "h" and "w" in Fig. 29. When installing either the flat or square keys, Fig. 20, a keyway is milled in the shaft as in Fig. 19. Standard gears, pulleys and other manufactured parts have the keyway formed in the hub. If these parts are being made in the home shop, hub keyways can be formed on a small bench shaper, or even with a hand file. Another way is to bore the wheel hub oversize, then turn a slotted sleeve to fit in the wheel hub. The sleeve is reamed to fit the shaft. It is then silver-soldered in the wheel hub as in Fig. 21. The slot in

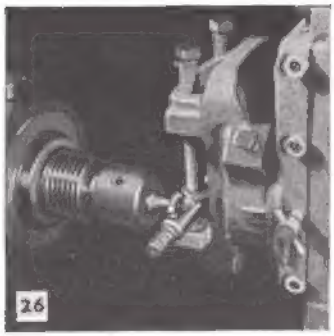


24 TABLE

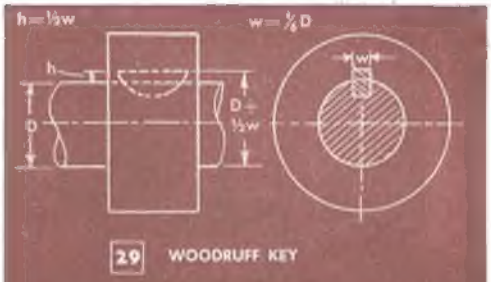
Shaft Dia. (Inches)	Square Key	Flat Key Width	Flat Key Height
½ to 5/16	1/8 X 1/8	1/8 X	3/32
5/16 to 7/8	3/16 X 3/16	3/16 X	1/8
15/16 to 1 1/4	1/4 X 1/4	1/4 X	3/16
1 3/16 to 1 3/8	5/16 X 5/16	5/16 X	1/4
1 7/16 to 1 3/4	3/8 X 3/8	3/8 X	1/4
1 13/16 to 2 1/4	1/2 X 1/2	1/2 X	3/8

25 TABLE

Length	Width					
	1/16	3/32	1/8	5/32	3/16	1/4
½	204	304	404			
5/8		305	405	505		
¾			406	506	606	
7/8				507	607	807
1					608	808
1 1/8					609	809
1 1/4						810



Slots for Woodruff keys are cut easily in the lathe with a milling attachment. Before removing the work, place a key in the slot and check depth with a micrometer. Right-hand photo shows application of the key

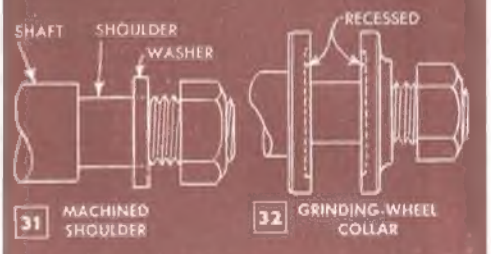


29 WOODRUFF KEY

30 TABLE

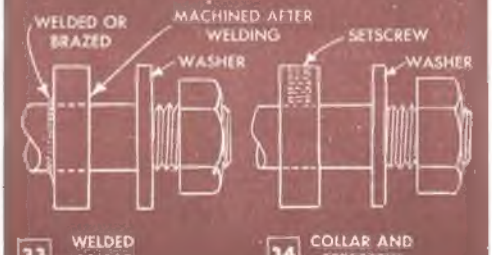
Shaft Dia. (Inches)	Woodruff Key Width	Code Number
5/16 to 3/8	1/16	204
7/16 to 1/2	3/32	304 etc.
9/16 to 3/4	1/8	404 etc.
13/16 to 15/16	5/32	505 etc.
1 to 1 1/16	3/16	606 etc.
1 1/4 to 1 3/4	1/4	807 etc.

Note: The Woodruff Key Code Number is derived as follows. First digit, width of key in 32nds. Second and third digits, length in 8ths. Thus 405 indicates a key 5/32 (1/8 wide) 4/8 long.



31 MACHINED SHOULDER

32 GRINDING-WHEEL COLLAR



33 WELDED COLLAR

34 COLLAR AND SETSCREW

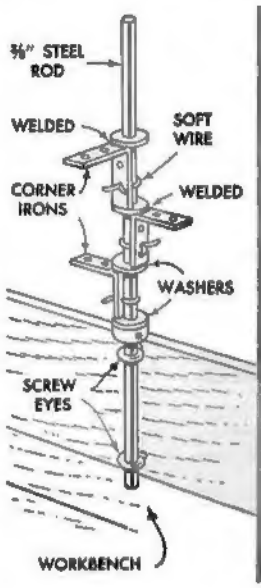
the sleeve allows the key to slip into place.

The lathe setup for cutting a Woodruff keyway with a milling attachment is shown in Fig. 26. After locating the position of the keyway, work is fed upward into the cutter by means of the vertical slide of the milling attachment. Before the shaft is removed from the milling-attachment vise, a key is inserted in the slot and the depth checked with a micrometer as in Fig. 27. A typical application of the Woodruff key is shown in Fig. 28. The table in Fig. 30 gives the recommended sizes of the Woodruff key to be used with a shaft of a given diameter. The special note directly below the table describes the meaning of the code numbers listed in the right-hand column.

Threaded arbors: Grinding wheels, circular-saw blades and circular-saw attachments, buffing wheels and wire scratch wheels are attached to the driving shaft or arbor by a compression-type fastening. Similar grinding and polishing accessories are attached to a flexible shaft in the same manner. The arbor is shouldered and threaded for a distance from one end, or both ends in the case of a motor-driven grinder, and is fitted with a nut and either one washer as in Fig. 31, or two loose washers, or flanges, as in Fig. 32. The latter is the common type of fastening used on saw arbors, although some are fitted with a welded inner collar or flange as in Fig. 33. Threads on the arbor are cut either right or left hand, depending on the direction of rotation of the shaft. In some applications where slight adjustments are necessary, the inner collar is attached to the shaft with a setscrew as in Fig. 34. Note that the grinding-wheel collars in Fig. 32 are recessed and that the outer flange is turned with a hub. Grinding wheels are fitted with lead sleeves and paper flanges on both sides to protect the arbor and the ground surfaces of the metal arbor flanges from abrasive action when attaching and removing the wheel. Paper flanges also help to prevent the wheel from loosening.

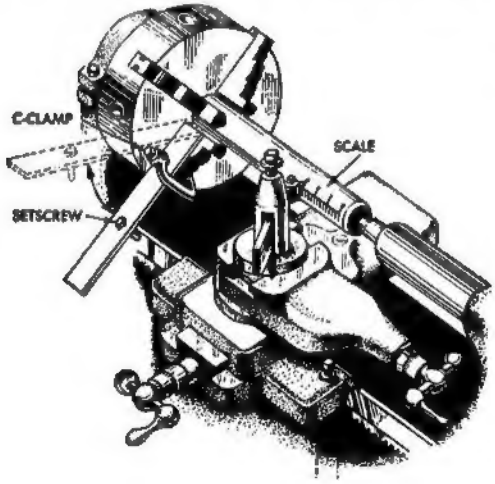
Muffin-Pan Rack Keeps Small Parts Handy

Muffin pans furnish the many separate compartments of a single-post small-parts rack. Mounted on a rod at the back of the workbench, the pans can be swung out of the way when not in use and pulled quickly over the bench for easy selection of a particular part. The rod is inserted through screw eyes turned into the bench back and is held in place by means of a collar. Each muffin pan is bolted to a corner bracket which, in turn, is welded to a washer. Then, the brackets are fastened to the rod with short lengths of soft wire. —Wilbur E. Baur, Leonia, N. J.

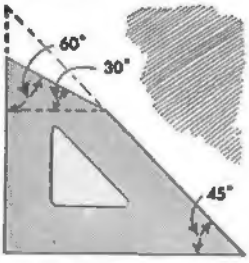


Lathe Pinch-Hits for Special Machine When Marking Calibrations

An occasional job of calibrating cylindrical work can be done neatly and uniformly, right in the lathe, by using a threading tool bit in the compound rest and a depth stop clamped to the lathe chuck. A thread-cutting stop on the cross slide also is helpful in setting the tool to a uniform depth for each cut. With the compound rest set parallel with the work, a base line is scribed on the work by advancing the cross slide. Next, a stop, consisting of a length of flat iron tapped at one end for a long setscrew, is attached to one of the jaws of the chuck with a C-clamp. Note before scribing the base line that this jaw of the chuck must be positioned to give the desired amount of swing. Adjustment of the setscrew in the stop determines the length, or depth, of the calibrations. To scribe the calibrations, the scale on the collar of the compound rest is set at zero. Then, with the stop set for the short lines, the tool bit is advanced to enter the base line and the stop is pressed downward until the setscrew touches the lathe bed. After each cut, the tool is withdrawn and the compound rest is turned to the next calibration. The procedure then is repeated for as many calibrations as required. To make the long lines, the setscrew is backed out and scribing is done as before.



Modifying 45-Deg. Triangle Increases Its Usefulness



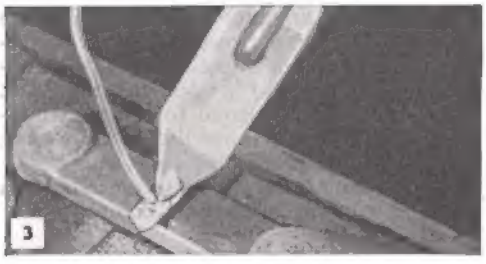
Cutting a 45-deg. triangle as shown in the drawing increases its range to include angles of 15, 30, 60 and 75 deg. These, of course, are obtained by placing the triangle in various positions against the T-square. To modify the triangle, mark off the 30-deg. line and cut slightly above the line. Then carefully finish to the line with a fine file.

REJUVENATE YOUR BATTERY

By Ed Packer

Softening sealing compound with a heated screwdriver will free the cell so that it is easily removed. Be careful not to spill acid solution in the case

Replacing cracked or warped separators with new ones restores defective battery cell to continued use. Support the cell at an angle in the case as shown

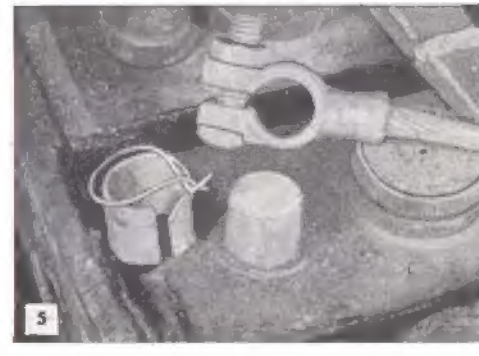


Above, soldering the cell-connector strap after cutting to remove a cell. Below, sealing a repaired cell into the battery case with a hot soldering iron

DIFFICULT starting, more use of lights and accessories plus the tendency of a battery to lose its charge during cold weather make it difficult for an old battery to function satisfactorily during winter months. If you are having "cold weather" trouble with your battery, the most satisfactory solution to the problem is to replace it, but if you feel that you must get additional service from it, possibly a major operation on one or more of the cells will keep it out of the junk pile for a few more months.

The usual sign of impending failure is a low gravity reading in one cell. Prompt repair often will save a battery in this condition, unless the plates have become "mushy" due to fast and frequent charging. To repair the battery, the faulty cell must be removed from the case and opened. If an end cell is at fault, it will be necessary to cut only one connector in order to remove it, but if the center cell is the faulty one, both connectors must be cut. Do this with a hacksaw as in Fig. 6. Then, heat the blade of a screwdriver and use it to melt the sealing compound around the top of the cell cover as in Fig. 1. Grip the terminal post with pliers and lift the element carefully, tipping it at an angle as it is raised and resting it on the battery case as in Fig. 2. The most common cause of a low cell is one or more cracked, broken or rotted separators which allow the positive and negative plates to touch, thus short-circuiting the cell and discharging it. Other possible causes are the "bridging" of sediment across the plates and over the tops of the separators, and also sediment built up in the bottom of the cell to such a height that it connects the plates. If separators

Battered or worn terminal posts are built up with molten lead, using a form made of sheet aluminum. Photo shows post rebuilt and metal form removed



Regular gravity checks with a hydrometer, renewal of electrolyte and prompt repair of a low cell will add many months to the useful life of an old battery

are broken or otherwise damaged, simply replace them with new separators of the proper size and material. Scrape excess sediment from the plates with a softwood stick and remove sediment from the bottom of the cell with a wooden spoon. Then, lower the plate assembly, or element, back into the case, making sure that the element seats properly.

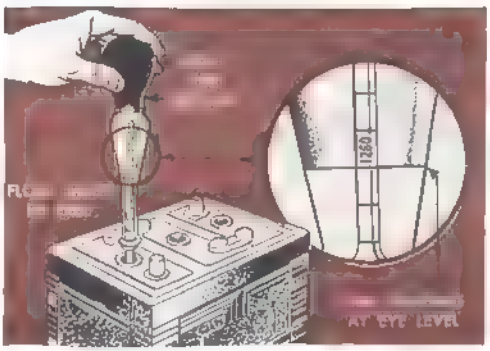
The meeting ends of the connector are filed to an angle of 45 deg. and the resulting vee is filled with lead melted into the joint with a hot soldering iron, Fig. 3. Reseal the cell cover by melting and running sealing compound into the joint with a soldering iron as in Fig. 4. *Caution:* Do not use an open flame to melt the sealing compound.

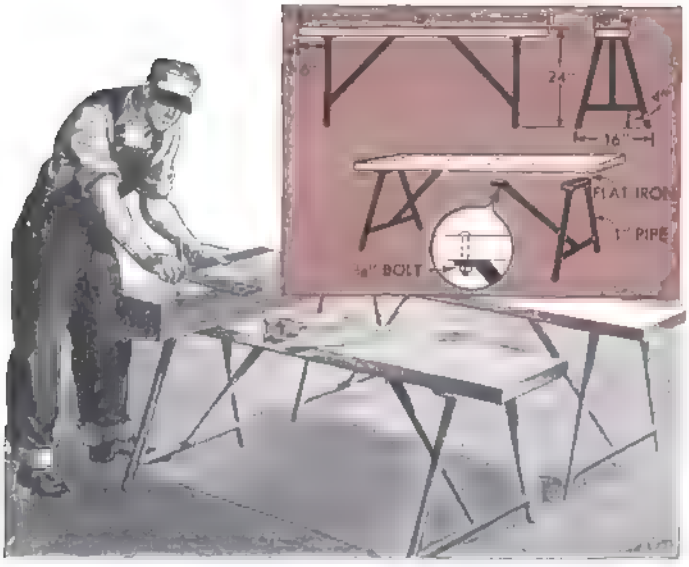
If the terminal posts of an old battery are battered or excessively worn, they should be built up to their original size and shape. Wrap the post with tape until its original diameter and taper are attained. Fit an aluminum collar, shown in Fig. 5, over the tape, binding it tightly with a piece of twisted wire. Then lift off the collar and strip off the tape. Replace the collar, centering it over the defective post where it serves as a form for retaining the molten lead, Fig. 7.

In a battery being repaired as described, there is an unknown amount of acid in the plates of the faulty cell. To equalize the solution, charge the battery until all cells are gassing freely and occasional checks with a hydrometer, used as in Fig. 8, show no rise in gravity over a period of four hours. This procedure assures that all the acid is once more in solution. To balance the solution in the low cell, withdraw liquid with the hydrometer until the tops of the plates are exposed. Then add acid of 1.400 gravity to bring the level of the liquid to the proper height above the plates. Should it happen that the solution in the defective cell was at a low level to begin with and the subsequent hydrometer check shows the gravity to be high, add distilled water instead. After this adjustment of the solution, charging should be continued for at least 30 minutes to mix the new acid or water with the liquid already in the cell. The gravity is again read and adjusting continued until the reading is 1.280 or 1.300.

To rebuild a worn post, wrap with tape to bring it to original size. Fit metal form over the tape and fasten with wire. Then remove form and the tape

Keep a regular check on the battery solution with a hydrometer. In cold weather add water just before driving car so that water will mix with solution



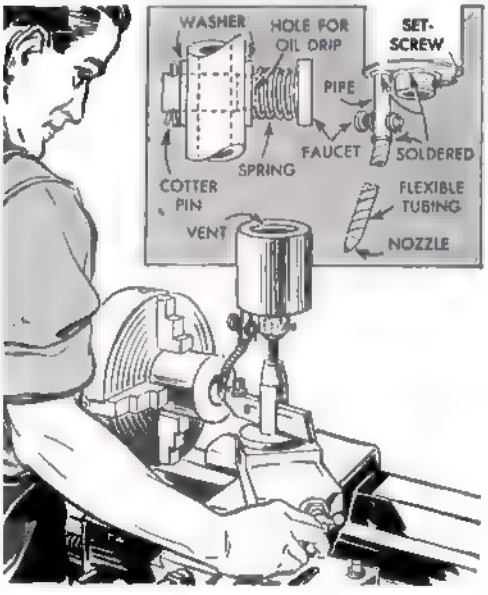


Sawhorse Benches Have Pipe Legs

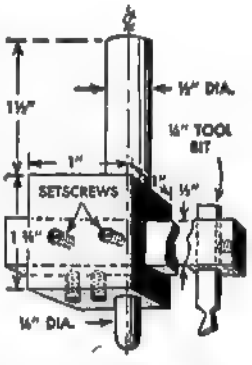
A pair of sturdy sawhorse benches, made to the dimensions given in the detail, will be invaluable around the shop by providing a rigid working surface even when the heaviest tools are employed. Each set of legs is made by welding together lengths of 1-in. pipe and a piece of flat iron. Bolt holes are drilled through the flattened end of the diagonal brace and also through the flat iron to permit fastening the legs to a plank.

Gravity Coolant Dispenser on Tool Post Rides With the Carriage

For a small lathe not equipped with a coolant system, this handy cutting-oil dispenser makes it easy to keep the tool bit well lubricated at all times. Being mounted on the tool post it rides with the carriage, out of the way, and has a flexible metal hose which directs the oil to the very tip of the cutting tool. A simple faucet controls the flow of oil. The details show how the dispenser is made. A section of pipe having an inside diameter which will fit over the square head of the tool-post clamping bolt is tapped for a setscrew and soldered to the bottom of a tin can having a press-type lid. Then a small hole is made in the bottom of the can and a length of tubing, in which the faucet is installed, is soldered over the hole. The flexible metal hose is soldered to the end of the tubing. Note that the drip hole in the faucet must be located at a point where the spring will keep it on the outside of the tube when the faucet is in the "off" position. It is important, too, that the bolt of the faucet be the same size as the inside diameter of the tube.



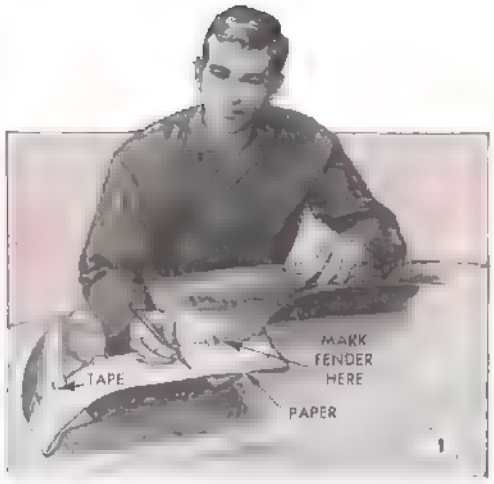
Counterbalanced Hole Cutter Uses Lathe Tool Bit



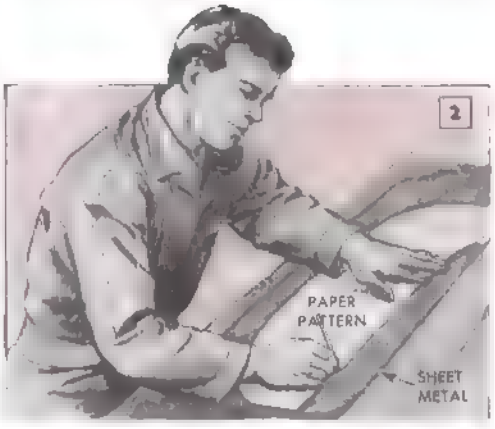
Designed to compensate for the overhang of the extended tool-bit holder, this hole cutter is balanced to rotate with little or no vibration. The shank and head of the cutter are machined in one piece, the shank and the pilot on the end being offset in the square head. A ½-in. hole is drilled through the head and squared with a file to take a 3-in. or longer arm. Another square hole is formed in the end of the arm for a ¼-in. lathe tool bit. Setscrews are used to lock both the arm and bit in place. Note the shape of the cutting edge.

FENDER REBUILDING

HAVE you noticed that the right rear fender of a car usually is the first one to rust through? Small stones and fine abrasive material thrown up by the wheel wear away the protecting finish and expose bare metal to water and road chemicals which tend to wash toward the curb in stormy weather. In time, rust eats away the metal to a paper thinness, necessitating either a new fender or a repair patch. Such a repair is made in a short time by following the simple procedure shown in Figs. 1, 2 and 3. Remove the fender, lay it on a bench as in Fig. 1, and place a sheet of heavy paper over the damaged area, holding the paper in place with tape. Mark the paper as indicated, the heavy pencil line following the lower edge of the fender. Also mark the fender along the top edge of the paper. Then cut the paper on the pencil line to get a pattern. Lay this on a piece of sheet metal of the same gauge as the fender, Fig. 2, mark, and cut to size with snips. Cut the fender along the line previously marked at the top edge of the pattern. Then weld the parts as in Fig. 3. Grind the joint flush and hammer the lower edge to shape over a bumping dolly, taking special care to draw the metal to the exact shape of the original fender to assure an accurate fit on the body. Fig. 4 shows the completed fender ready for installation and refinishing to match the body color.



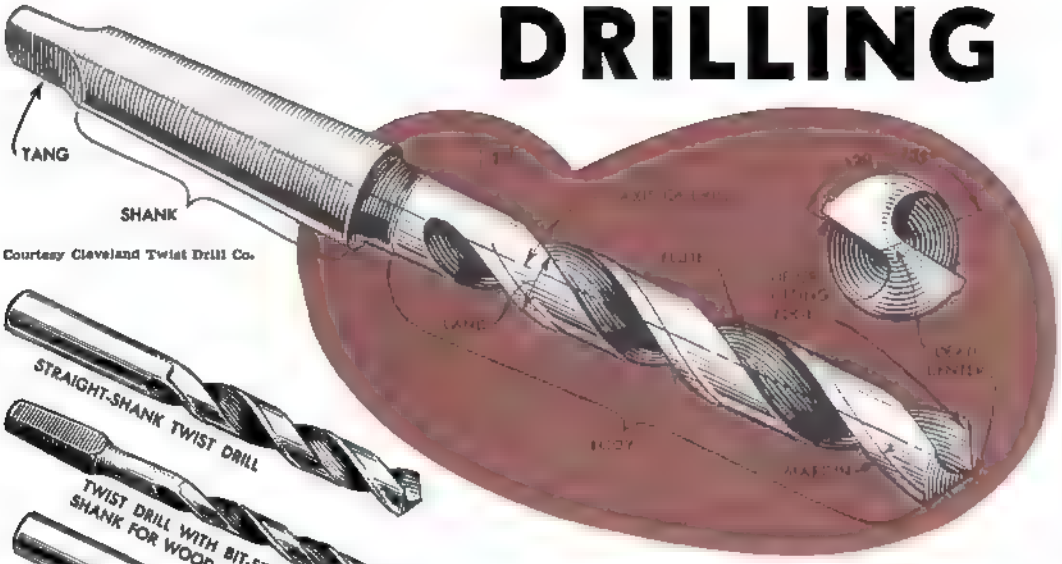
Paper is taped over the damaged area of the fender and the outline of the damaged portion is marked on it to make a pattern for cutting the repair part



Then the pattern is cut out and its outline transferred to soft sheet metal of the same gauge as the fender. After marking, the sheet metal is cut to size

Finally, the repair part is welded to the fender and hammered to conform to shape at the lower edge

DRILLING



Courtesy Cleveland Twist Drill Co.

2 TYPES OF DRILLS

By Thomas Trail

ALTHOUGH the actual operation of drilling metal or wood is one of the simplest shop procedures, skill and "know how" are required to keep the drills sharp, to know the correct speed and lubricant to use and the right drill for the job at hand. The principal parts of a drill are shown in Fig. 1. The dead center should be on the exact center of the drill axis and the cutting edges must be equal both in length and in angle. The margin is a narrow, raised rib with a cutting edge being the full diameter of the drill. In operation, the rib accurately sizes the hole and reduces friction. The shank is the end of the drill that is held by a drill-press chuck or a taper socket. The drill shown has a tapered shank with a tang on the end which engages a slot in the small end of the tapered socket to give a positive drive. Drills also are made with a straight

3 CAUSES AND CURES FOR COMMON DRILL TROUBLES

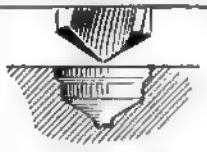
BREAKING OF CUTTING EDGES AT CORNERS

CAUSE

1—Too much lip clearance
2—Material has hard spots, sand inclusions or scale
3—Drill running too fast
4—Wrong cutting compound or lubricant
5—Feed too rapid

CURE

1—Regrind and reduce lip clearance to between 12 and 15 degrees
2—Reduce speed
3—Reduce speed
4—Use proper lubricant or compound
5—Reduce feed



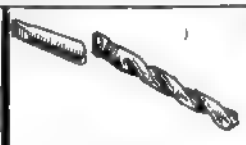
OVERSIZED HOLE

CAUSE

1—Length and angle of lips not equal

CURE

1—Regrind drill and equalize lip angles and lip lengths



BROKEN TANG

CAUSE

1—Poor fit of tang in socket caused by nicks, burrs, dirt or wear
2—Mutilated tang

CURE

1—Ream old socket or replace with new one. Cleaning sockets before use lengthens their life
2—Dress or replace

CHIP FORM CHANGES

CAUSE

1—Lubricant not reaching proper location

CURE

1—Drill chipped, dulled or damaged — inspect and regrind
2—Remove drill and check lubricant

DATA

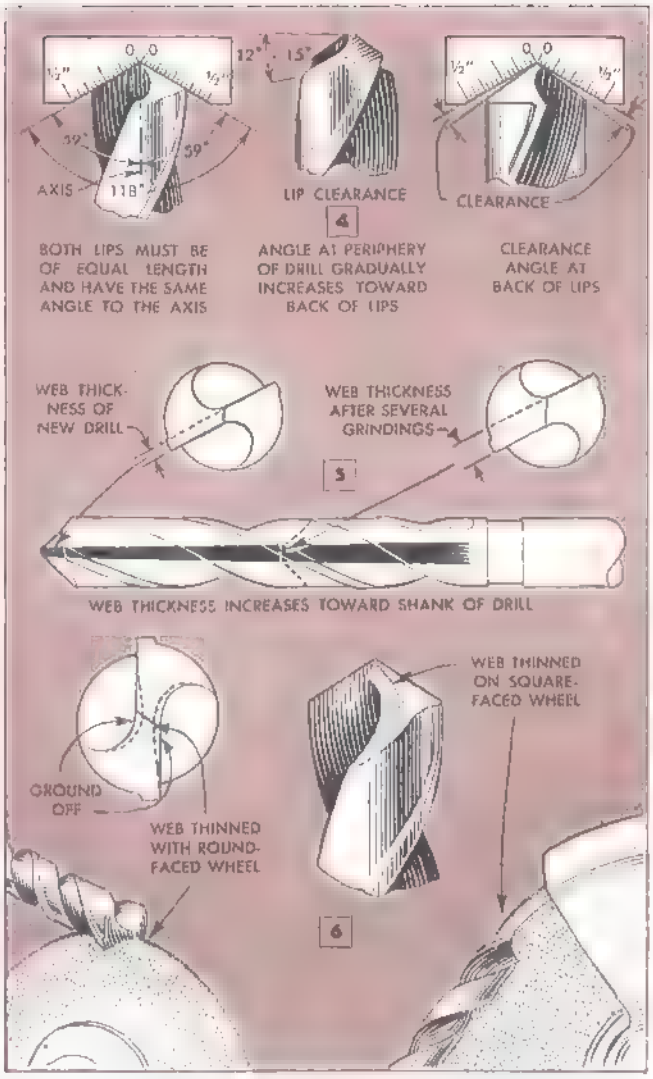
shank and a bit-stock shank, as in Fig. 2. The diameter of a drill decreases slightly from the cutting point in order to prevent binding in the drilled hole. Sizes are designated in four classifications. Number drills range from No. 80 to No. 1 (.0135 in. to .228 in.); letter drills from A to Z (.234 in. to .413 in.); fractional drills rise from 1/64 in. upward by 64ths, and metric drills are listed from .5 mm. to 10 mm. by .1 mm., larger than 10 mm. by .5 mm.

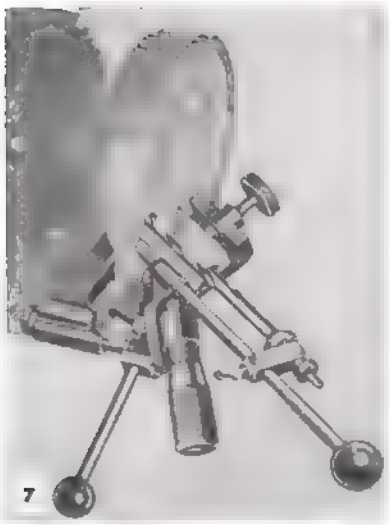
Normally, the cutting edges of a new drill gradually wear away with use and require sharpening. A dull drill will not cut properly and may be damaged by excessive heat generated by friction at the cutting point. Drills should be sharpened on a medium-grit grinding wheel. To prevent a drill from overheating and losing its temper while grinding, it should be dipped frequently in water while being sharpened. Cold water should not be used for this purpose, however, as it may cause cracking or distortion of the drill bit.

Most drilling trouble is due to faulty grinding of the cutting-edge clearance and angle. The two cutting edges of a drill must be made equal both in length and angle, and the angle must be such as to produce best results in the material to be drilled, Figs. 3 and 4. For average drilling, an angle of 59 deg. at the cutting edges has been found most satisfactory and new drills are ground to this angle unless made for special purposes. A drill gauge, Fig. 4, is used to check the angle of the cutting edge when grinding.

If either the lengths or angles of the cutting edges are ground unequally, the drill will drift and form an oversize, stepped hole. This will happen even though lip clearance is correct for the angle at which each lip is ground. The clearance, as shown in the center and right-hand details in Fig. 4, allows the drill to penetrate the material being drilled. For average work the clearance angle back of the cutting edges should be between 8 and 12 deg., but it is sometimes increased to 15 deg. where heavy feeds are taken in soft materials. When cutting-edge clearances have been ground uniformly to the proper angle, the angle subtended by the dead-center line and each cutting edge should be at least 120 deg., and not more than 135 deg., as shown in Fig. 1. Excessive clearance will weaken the cutting edges and cause them to break down. Insufficient clearance will prevent the drill from properly penetrating the material and may result in splitting the drill. After grinding, the drill point should be checked carefully to assure accuracy of the cutting-edge lengths and angles, the clearance angles and the location of the dead center.

Although with practice the mechanic can do an accurate job of drill grinding





Atlas Press Co. photo

8 DRILL SPEEDS AND FEEDS

R.P.M.

10,000 9,000 8,000 7,000 6,000 5,000 4,000 3,000 2,000 1,000 900 800 700 600 500 450 400 300 200 100

FINDING DRILL SPEEDS

1—NORMAL SPEED (N) WILL BE FOUND ON CURVE AS ¼" OR .250" DRILL (BOTTOM) REQUIRES 450 R.P.M. (LEFT)

2—MULTIPLY (N) BY VALUE SHOWN IN TABLE BELOW

METAL TO BE DRILLED	KIND OF DRILL	
	Carbon Steel	High Speed
CAST IRON (annealed)	2½ X N	5 X N
CAST IRON (hard)	N	2½ X N
MILD STEEL	N	3½ X N
DROP FORGINGS	½ X N	2 X N
MALLEABLE IRON	1¼ X N	3 X N
CAST STEEL	½ X N	1½ X N
TOOL STEEL	¾ X N	1½ X N
BRASS, BRONZE AND SOFT METALS	5 X N	10 X N

DIAMETER OF DRILL (INCHES)

0.1" 0.2" 0.3" 0.4" 0.5" 0.6" 0.7" 0.8" 0.9" 1"

FEED IN INCHES PER DRILL REVOLUTION

⅛"	¼"	½"	LARGER
.001 TO .002	.002 TO .004	.004 TO .007	.007 TO .015	.015 TO .025

LUBRICANTS

Cast Iron—None
Mild Steel—Lard Oil
Drop Forgings—Lard Oil
Malleable Iron—Soda Water
Tool Steel—Lard Oil
Cast Steel—Lard Oil
Brass and Bronze—Dry or Paraffin Oil
Wrought Iron—Lard Oil
Aluminum—Kerosene

by hand, use of an automatic grinding attachment, Fig. 7, is recommended. This will produce an accurately ground drill point and will save excess grinding.

When drilling hard material it is sometimes desirable to use a heavy feed pressure. To prevent the drill from chipping, a narrow flat is ground on the leading side of each cutting edge. Care must be taken not to give the edge a negative rake, however, as this would cause heating and possible breakage. This type of drill point also is used when drilling soft materials, such as brass, where a normal point may tend to dig in. Note from Fig. 5 that the web increases in thickness from the cutting point to the shank to give the drill greater rigidity. As a result, the web becomes thicker at the point after a number of sharpenings and must be thinned by grinding to maintain ease of penetration of the drill point. Fig. 6 shows two methods of reducing the thickness of the web at the point. The best way is to use a round-faced grinding wheel, the radius of the wheel face being less than that of the flutes. Another method is to grind a bevel on the trailing edge of the heel as in the upper right-hand detail of Fig. 6, using a square-faced wheel. Except for cast iron, which is drilled dry, most metals require use of a lubricant for best results. Lubricant serves a threefold purpose. It dissipates heat rapidly, lubricates the drill at the cutting edges and aids in the formation of uniform chips. This results in smooth, clean work with a minimum of wear on the drill.

The chart, Fig. 8, makes it easy to figure proper drill speeds and feeds in all common drilling operations. It also lists the correct lubricants used on various types of metals.

Work to be drilled should be clamped securely to the drill-press table and the drill should be held firmly by the chuck or taper socket. When using taper-shank drills, see that the shank and the inside of the socket are smooth and free from grit, and that the drill tang is not damaged. Use a block of wood to drive the drill shank tightly in the socket. In removing the drill from the socket, place a piece of wood under the drill point to prevent it from striking the drill-press table or the work, and use a drift of the correct size to drive out the drill. When drills are used at the bench, keep them in a metal stand especially made for the purpose. Drills not in use should never be stored loose in a drawer or chest or together with other tools as they are likely to become nicked or otherwise damaged. Stored drills should be oiled to prevent rusting.

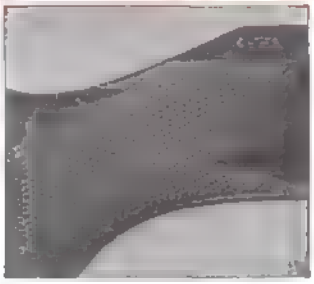
Testing Gear Compound for Grit

Whether or not gear grease contains grit can be determined by placing a small amount of the grease between two clean pieces of glass. These are rubbed together until a thin film of grease remains and then held up to the light. Any foreign particles will be apparent.

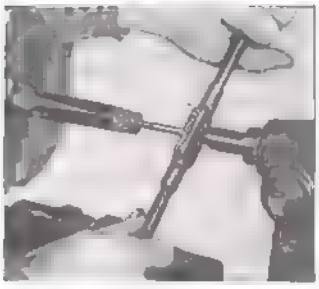
CRAFT QUIZ

1. Cutting tool used here has—
(a) 59° point (c) Extension spurs
(b) Brad point (d) Double flutes

2. Tin snips shown are—
(a) Straight blade (c) Hawk-billed
(b) Pivoter (d) Double cutting

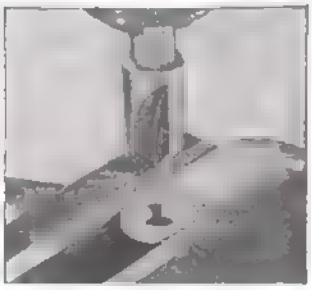


3. This work is called—
(a) Squaring (c) Hatching
(b) Pointing (d) Checkering

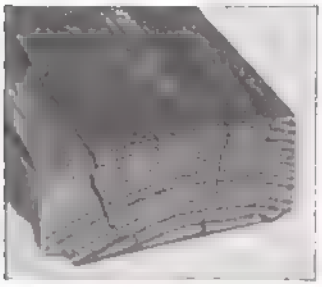


4. National coarse tap used here is—
(a) ¼" No. 20 (c) No. No. 6-40
(b) 5/16" No. 24 (d) ⅜" No. 24

5. Placing roofing in the—
(a) Gutter (c) Comb line
(b) Verge-edge (d) Valley



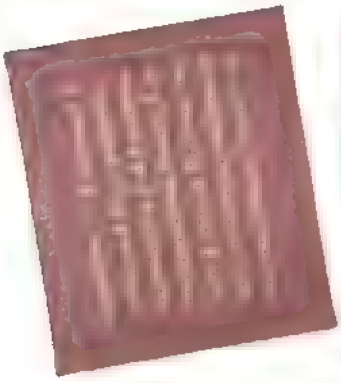
6. Countersink for screws is—
(a) 60 degrees (c) 72 degrees
(b) 20 degrees (d) 82 degrees



7. This "two-by-four" has—
(a) Edge grain (c) Banks
(b) Star shakes (d) Checks

8. This knot is—
(a) Half hitch (c) Blackwall hitch
(b) Sheepshank (d) Single bowline

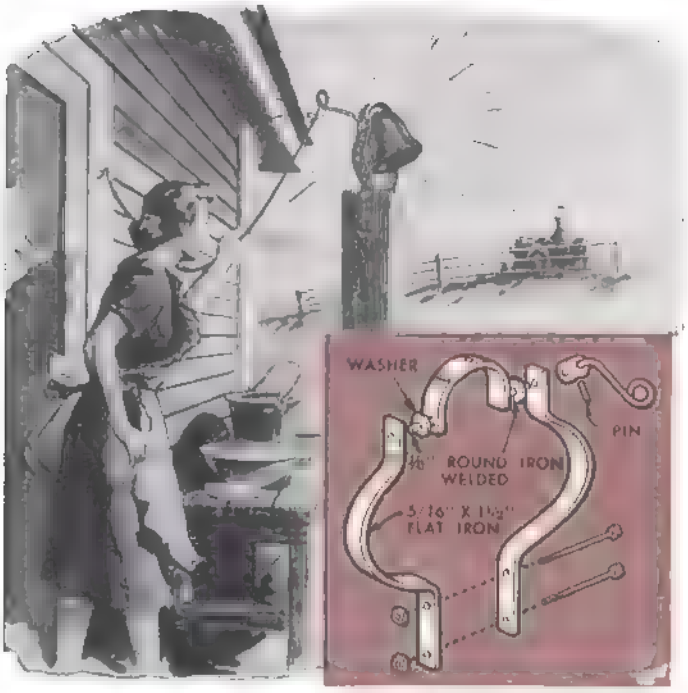
9. Ears on this clamp are for—
(a) Better grip (c) Identification
(b) Speed (d) Easy turning



10. This type of table is—
(a) Extension (c) Pie plate
(b) Kettle (d) Drum

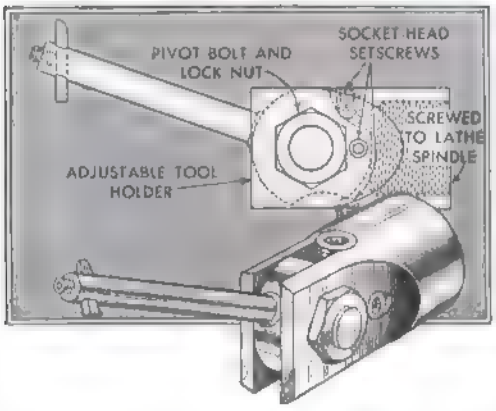
11. Jointers have a—
(a) Splitter (c) Rabbeting ledge
(b) Dado head (d) Depth stop

Ship's Bell Serves as Efficient Dinner Gong When Mounted on Brackets Near Farmhouse Door



Sending welcome signals far over the fields, ships' bells make excellent dinner bells for use on the farm. One of these bells can be mounted conveniently on a post outside the farmhouse door by means of a bracket made from flat iron. The side pieces are bent to clear the flared mouth of the bell and holes are drilled in each of them for bolts and stub axles. Short pieces of iron rod brazed to a curved flat-iron cross member serve as the stub axles. Washers provide clearance, and a heavy wire arm is brazed to a piece of rod, drilled and cross-pinned to one of the axles. The bell is attached with a screw inserted through a hole drilled in the top of the cross member. A rope pull runs through an eyelet or pulley to a handy spot.

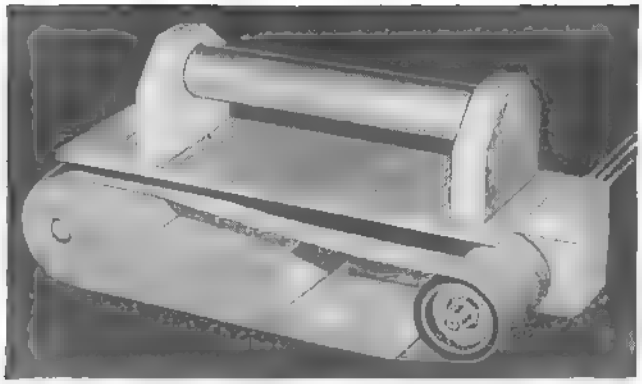
Stub Boring Bar Fits Lathe Spindle to Handle Large Work



Designed for boring and facing operations on work which is too large to swing between centers, this unusual boring tool is screwed onto the threaded lathe spindle and operated eccentrically, in a manner similar to a fly cutter. The tool-bit holder pivots and is adjusted for swing by means of two socket-head setscrews, while a third setscrew serves to hold the bar in position until the locknut on the pivot bolt is tightened securely. The locking setscrew should be a wringing fit to overcome the tendency to loosen by vibration. With the work remaining stationary and the tool rotating, size and shape of the work determine the manner of mounting, whether it be on an angle plate or the compound-rest saddle.

Doubling Use of Small C-Clamps

When gluing together the parts of drawers, boxes, etc., and the C-clamps at hand are a little too small to be used singly, simply hook two of them together as shown and use as one clamp. While the two clamps will stay hooked together when they are tightened, they can be temporarily wired together to facilitate applying them singlehandedly. In addition, if a long bar-type clamp is needed for clamping large frames, two C-clamps can be linked together by a piece of wood which has a hole in each end.

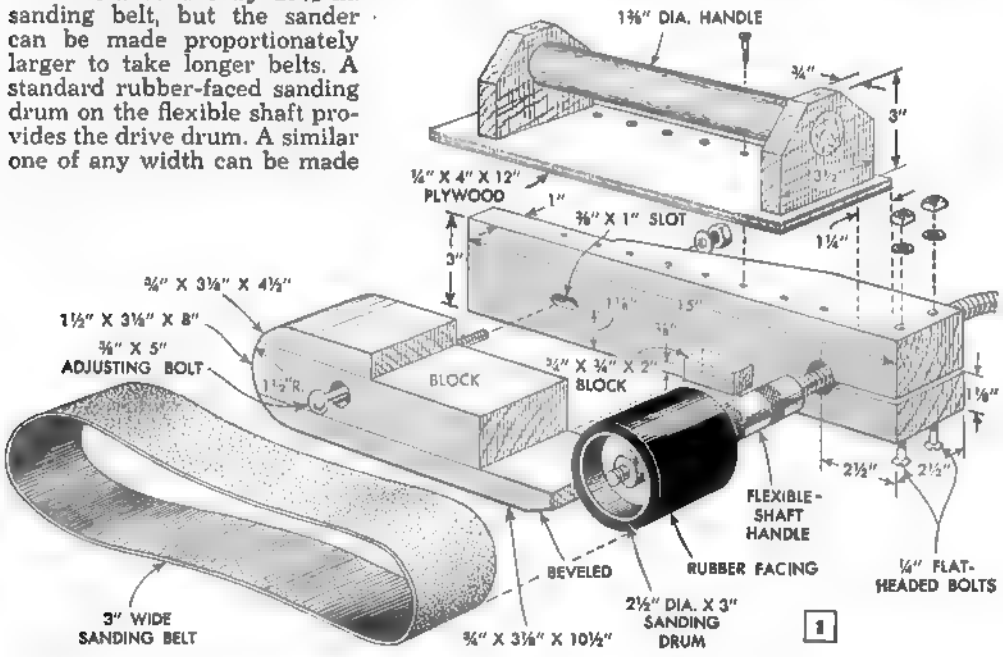


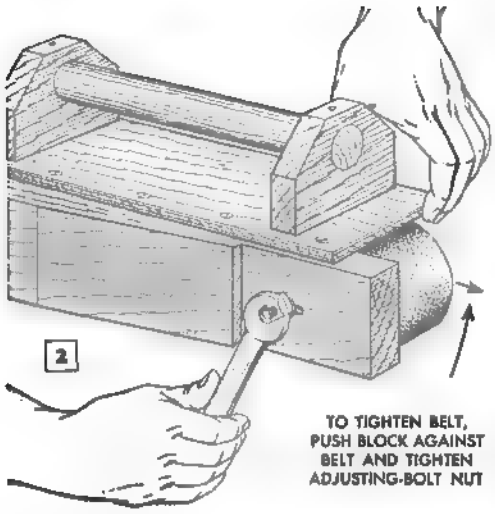
BELT SANDER

By A. B. Carper

I NEEDED a belt sander, but couldn't justify the expense of a self-contained unit, so I made one, which is electrically driven through a flexible shaft. It works efficiently and, being made entirely from scraps of hardwood, costs only the price of a 3-in. sanding belt and a few bolts.

The pull-apart drawing, Fig. 1, shows the assembly of the sander and dimensions all the parts. The dimensions given accommodate a standard 3 by 29½-in. sanding belt, but the sander can be made proportionately larger to take longer belts. A standard rubber-faced sanding drum on the flexible shaft provides the drive drum. A similar one of any width can be made by placing a number of solid-rubber disks between two metal washers or on a threaded shaft and clamping them together with a nut. Then, the drum is trued while rotating by holding coarse sandpaper or a grinding wheel against the rubber. The block used for the frame is clamped to the handle of the flexible shaft by means of a slotted hole, which is bored exactly at right angles to the inner face of the frame. Two



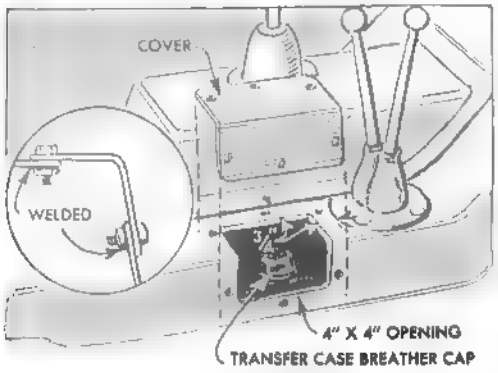


flat-headed stove bolts take up on the slotted hole and clamp the shaft rigidly. The opposite end of the frame is slotted to take an adjusting bolt on which the tension assembly pivots. The latter consists of three separate blocks, although it can be a single block. It is movable back and forth in the slot to permit proper belt tension. When mounted, the belt surface of the tension assembly is ⅜ in. below the frame. The assembly is held at a horizontal plane by a small stop block screwed to the frame.

This block permits the assembly to float when the sander is lifted but keeps the bottom or shoe of the assembly level with the face of the sanding drum. A plywood guard keeps the hand from coming in contact with the belt. This overhangs the frame to cover the belt and is attached with screws. Two blocks, bored to take a length of curtain pole which serves as a handle, are screwed to the plywood guard before attaching the latter to the frame. A nail driven through the handle at each end pins it in the holes in the blocks. Proper tension is maintained as the belt stretches by loosening the nut on the back of the frame, Fig. 2, and pushing the tension assembly forward in the slot. Avoid operating the sander with the belt too tight. Excessive friction produced by the belt passing over the wooden tension assembly will only tend to wear the belt prematurely. Waxing the bottom and the rounded end of the assembly will help to reduce friction.

The flexible shaft should rotate counterclockwise at about 1750 r.p.m. A ¼-hp. motor will furnish ample power. In using the sander, apply very little pressure and keep it moving. If a stand is made to hold the sander in an upside-down position, it can be used as a bench sander.

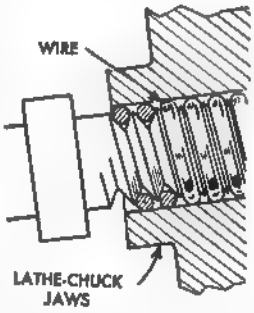
Floor-Board Opening on Jeep Gives Easy Access to Breather Cap



Because of the inaccessible location of the breather cap and ventilator in the transmission, owners of war-surplus jeeps are apt to neglect cleaning the caps and plugged ventilator holes regularly. This results in leaking oil seals and rusted transfer cases. To get at the cap requires reaching up under the floor boards in a space above the transfer case barely large enough for the hand and removing a cotter key from the reverse side of the breather cap. However, a simple solution to the problem was discovered during the war.

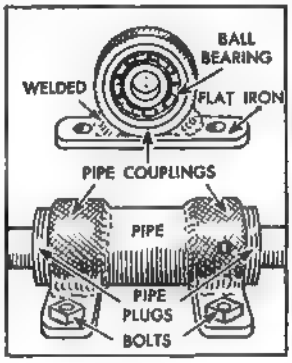
An opening is cut in the metal floor board directly over the breather cap so that it can be reached by removing a plate covering the opening. The breather cap usually is located approximately 2½ in. back from the dust cover on the gearshift levers and about 3 in. from the ¼-in. raised plate reinforcing the floor board. The detail shows how nuts are soldered to the floor board to take short cap screws which hold the plate.

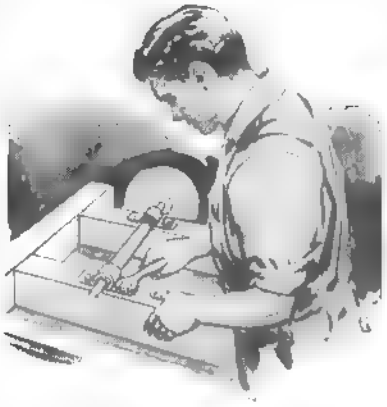
Chucking Threaded Work



Having to chuck the threaded end of a piece of work in a lathe for facing, I discovered a simple way to keep the thread from being damaged. I wrapped a piece of wire around the thread so that the chuck jaws would bear against the wire. The wire should be heavy enough to keep the jaws from injuring the top of the thread.—Shiro Fujihira, Seattle, Wash.

Pipe Fittings and Flat Iron Provide Housings For Ball-Bearing Pillow Blocks and Arbors



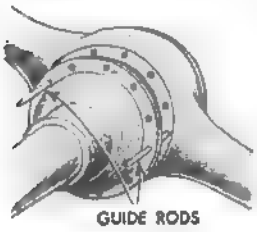


Ball-bearing pillow blocks and arbors were made by one man at a fraction of the purchase price, using secondhand ball bearings mounted in sections of pipe coupling. He selected a pipe coupling with an inside diameter the same or a little smaller than the outside diameter of the bearing. Then he cut the coupling in two, using one half for each bearing housing, and filed down the threads to provide a press fit for the bearing. This section was welded to a piece of flat iron drilled near each end to permit bolting in place. He made the arbor by welding a piece of pipe between two pillow blocks. Then, removing the square portion from two pipe plugs, he drilled holes through them slightly larger than the arbor. One of these plugs was screwed into each housing, a heavy felt washer being used between the ball bearing and plug to serve as a grease retainer. The unit is drilled and tapped for a grease fitting. The pipe plugs should tighten against the outer races of the bearings to keep them from turning. If desired, the bearing also can be clamped by inserting a setscrew through a hole drilled and tapped in the side of each coupling.

D. C. Marshall, Manhattan, Kans.

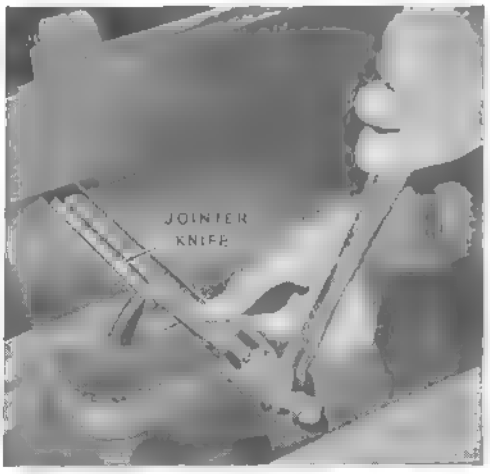
Drive Shaft Aligned to Differential With Aid of Guide Rods

Difficulties often experienced in attaching the drive-shaft housing to the differential housing can be overcome by using guide rods made from long stud bolts or regular bolts with the heads cut off. In either case, the projecting ends of the rods should be ground to a taper point to aid in starting them in the holes in the drive-shaft housing. Two rods are required and are turned into the cap-screw holes in the differential housing, locating them opposite each other. In use, the drive-shaft housing is lined up in its proper position, then slipped over the guide rods and pushed into place. After a few of the cap screws have been driven, the guide rods can be removed. This method makes it unnecessary to twist and jiggle the drive-shaft pinion and housing assembly to get it in alignment with the differential.



D. W. Brentlinger, Richmond, Calif.

When new spark plugs are installed, they should be properly tightened in the engine block. This is particularly important if all-copper gaskets are employed.



Adjusting Nicked Jointer Knives Results in Smooth Cut

It's not always necessary to regrind nicked jointer knives to obtain a smooth cut. As the knives usually have ⅛-in. clearance at the ends, it is possible to move them laterally in order to stagger the nicks, so one knife will remove the slight ridges formed by the other knives. To do this, loosen the clamp screws and tap the knives lightly with a piece of brass and a hammer. After moving, the knives must be reset carefully to the proper height.

Henry Hanscom, Elmhurst, Ill.

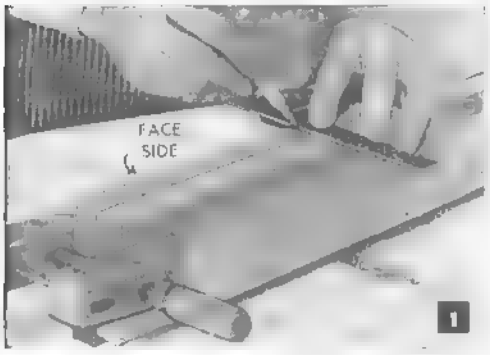
STRONG CABINET JOINTS

By Sam Brown

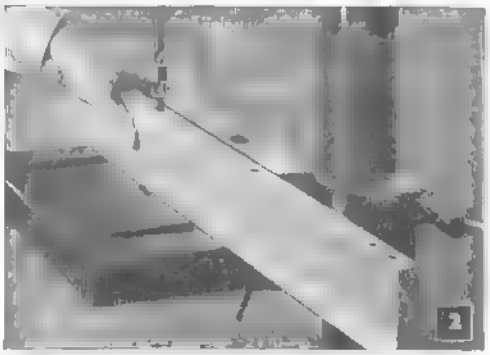
FOR MOST types of joinery, a good dowel joint is adequate. It can be made quickly and compares favorably in strength with mortise-and-tenon joints. It's the ideal joint for toys and light furniture construction.

Edge joints: Joining boards edge to edge is a common application of the dowel joint. The preferred method of working calls for clamping the boards together, face sides out, as in Fig. 1, and ruling crosslines to indicate the dowel position. A spacing of 8 to 10 in. between dowels is recommended, with two dowels at each end, Fig. 3. All drilling of holes is done with the face side of the work against a fence mounted on the drill-press table, as shown in Fig. 2. This automatically sets the crosswise spacing and makes all dowel holes a uniform distance from the face surface. The fence itself should be short and of sufficient thickness to assure accurate alignment parallel with the drill.

In a second method of working, no pencil guide marks are used, and the work is simply held against the fence while the holes are spaced by eye. Dowel centers, or pops, are inserted in the holes, and then, by contacting the two boards face downward, Fig. 6, registering marks are transferred to the second board. Dowel centers can be purchased, or they can be turned from cold-rolled steel to the shape shown in Fig. 4. If drilling is done by hand, both methods described require a stop on the drill bit to set the depth. This can be

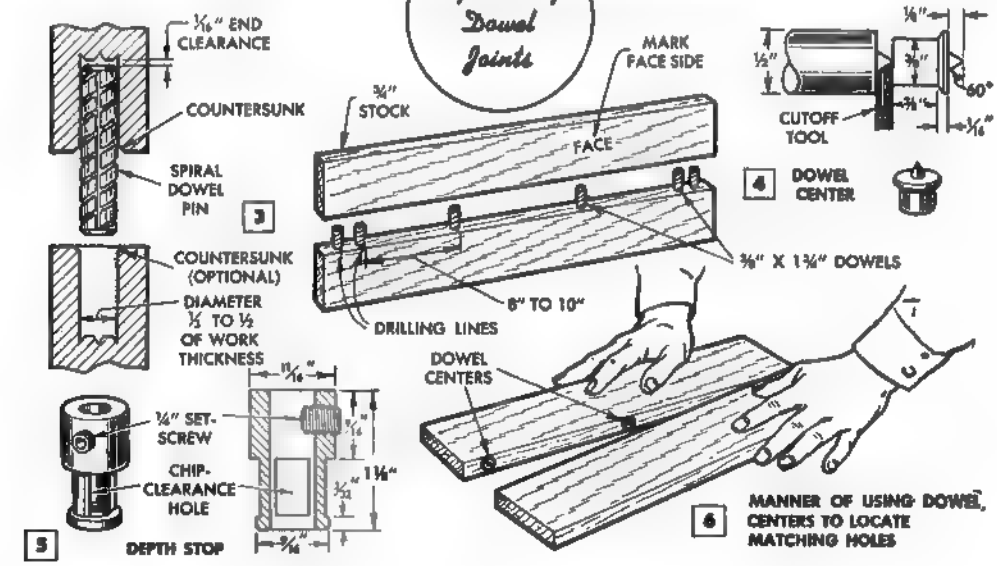


Clamp work together with face sides out and rule crosslines to locate dowel holes



Center the work with face against the fence and bore dowel holes on the lines

Edge-to-Edge Dowel Joints

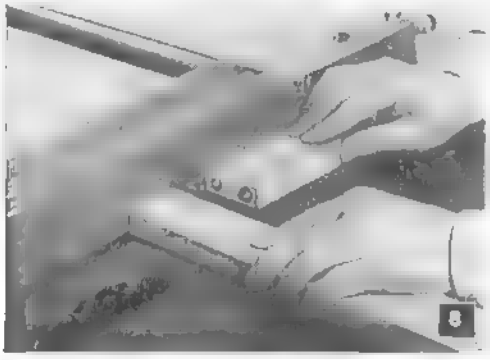


with DOWELS

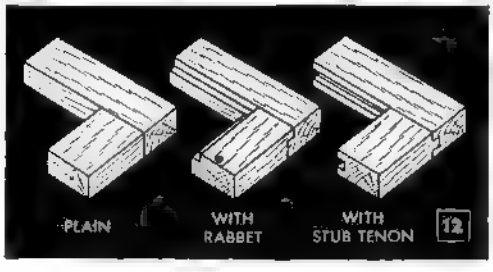
made as shown in Fig. 5, or a short dowel can be drilled lengthwise and slipped over the bit. As most joints are made with ⅜-in. dowels, one size of stop will do. Occasional work requiring smaller or larger dowels can be drilled for depth by fastening adhesive tape around the bit.

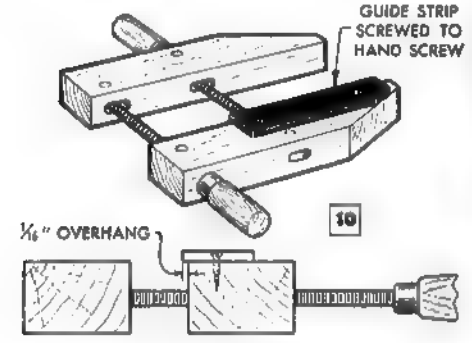
Corner joints: This is the most used dowel joint. The best method of making it is to drill the end-grain holes first, Fig. 7, spacing them by eye, and then use dowel centers for locating the side holes in the second piece, as shown in Fig. 8. A fixed fence is not used for drilling the side holes, but it is advisable to use a backing block or floating fence, Fig. 9, to keep the work square with the table. The difficult part about this joint is drilling the holes in the

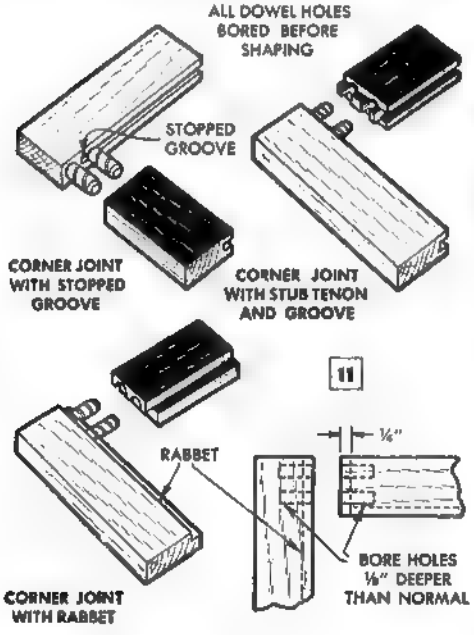
Bore holes in end grain first, spacing them by eye

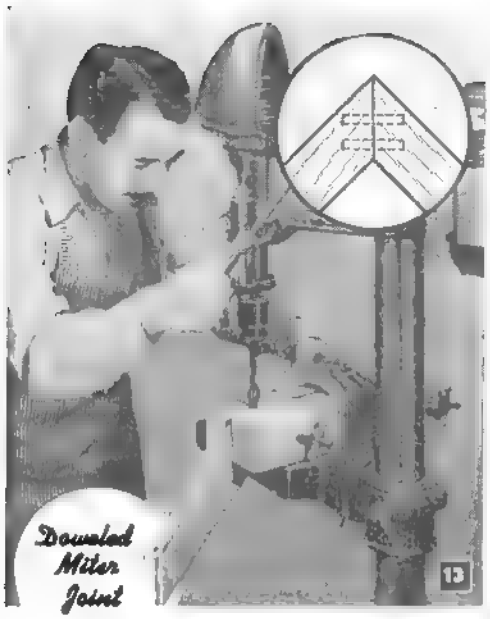


Above, locate position of side holes with dowel centers. Below, drill side holes with work against block

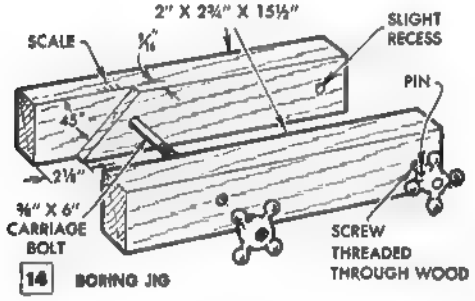








Doweled miter joints are easy to make with boring jig below



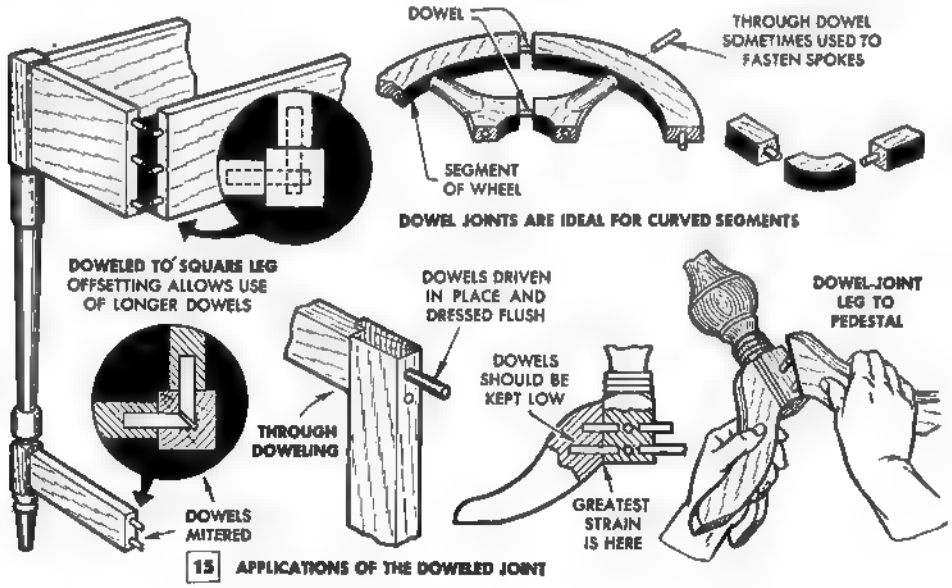
14 BORING JIG

end grain of the first piece. However, this is made easy with a handscrew fitted with a stop, as shown in Figs. 7 and 10. In use, the work is aligned with the bit by clamping it in the handscrew so that the end butts squarely against the stop attached to the jaw. Then the table is swung to one side to support the handscrew. Note that the table must be at right angles to the bit.

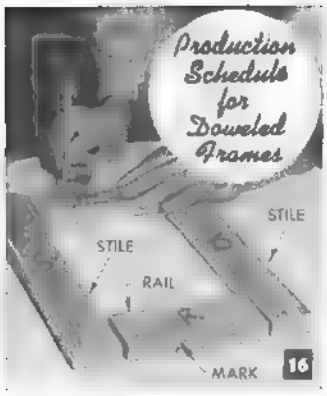
Various forms of the corner joint are shown in Figs. 11 and 12. Where the work is to be grooved or rabbeted, dowel holes should be drilled first. The stub tenon and rabbeted frames, Fig. 11, will lose ¼ in. at the joint when shaped, and this should be allowed for. Make rails ½ in. longer than normal, and drill dowel holes ⅛ in. deeper.

Doweled miter joint: Dowel holes are always bored at right angles to the contacting surfaces which are to be joined. This is fairly obvious in the 45-deg. miter joint, Fig. 13. Working with the handscrew setup, or with the somewhat similar boring jig shown in Fig. 14, the contacting surface of any joint is presented squarely to the drill. The method of making a miter joint is the same as a corner joint—eye-space the first piece and then use dowel centers to locate holes in the second piece.

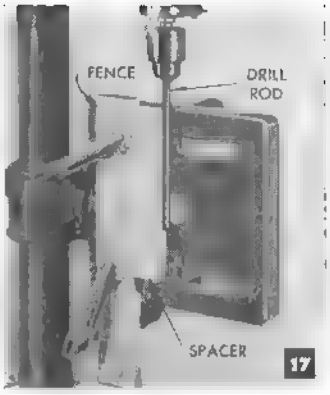
Various applications: While there are many uses for the dowel joint, all dowel joinery follows the same pattern, that is, two butting surfaces joined together with dowel pins. Typical work is shown in Fig. 15. For all occasional work, the dowel-center method of locating holes is used, and holes in end grain are drilled first, because it is difficult to mark accurately and spot a drill on this kind of surface.



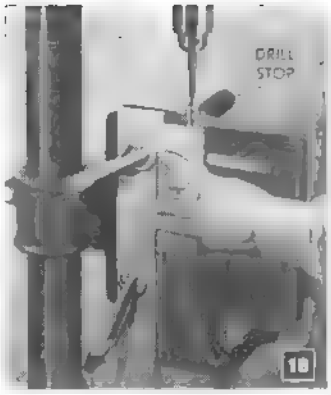
15 APPLICATIONS OF THE DOWELED JOINT



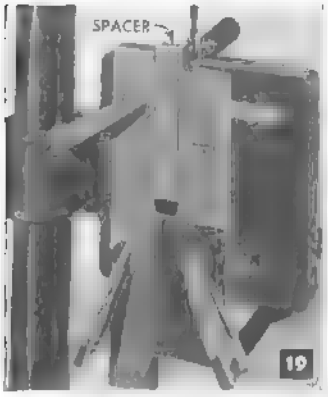
First, make rough assembly of frame, mark face side and outer edge of all members with pencil



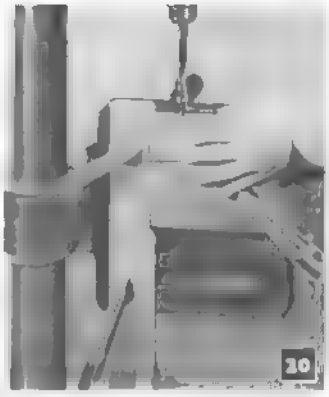
Next, with drill-press table tilted vertically, insert drill rod in chuck and align fence with rod



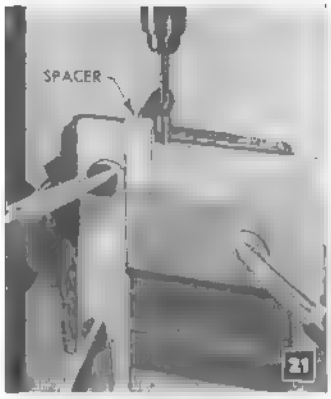
Drill the end holes in all rails first, placing the marked edges against a fence clamped to table



Drill second hole in end of rails by using same setup plus wooden block to space holes desired width



With work positioned by vertical fence plus horizontal rest, drill first end holes in stiles of frame

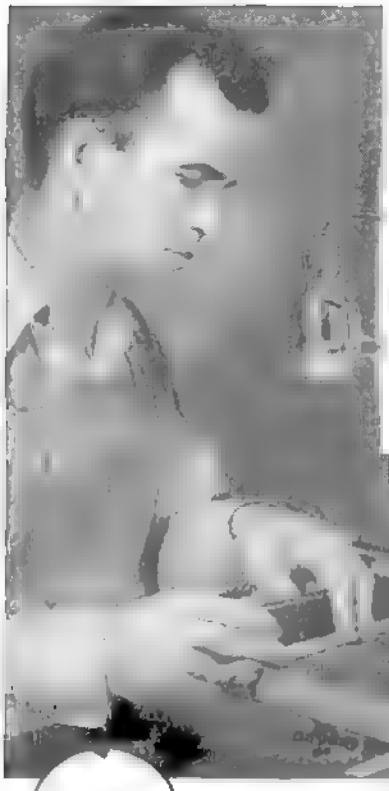


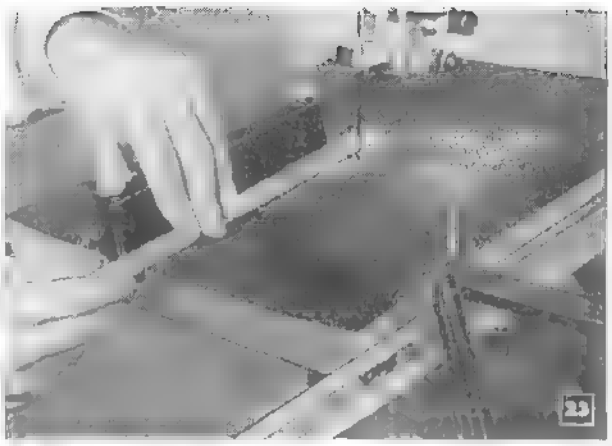
As in drilling second dowel hole in ends of rails, repeat same operation, using short spacer block

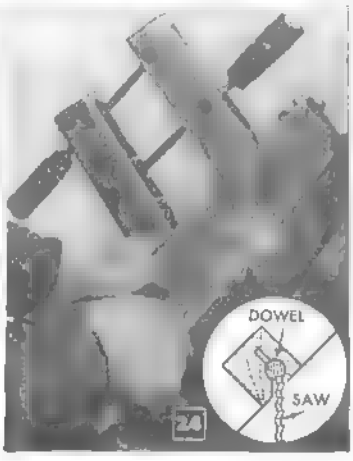
Production work: Dowel centers are too slow for production work, and various methods employing box jigs or spacers give better results. The schedule for a doweled frame is pictured in Figs. 16 to 21 inclusive. In this setup, one stop is clamped to the drill-press table, and this stop is used for both parts of the joint, giving perfect accuracy in the lengthwise spacing. As each joint consists of a right and left-hand member, the face side will alternately face toward and away from the fence. This makes it essential that, (1) the work be of uniform thickness, and (2) the drill must be exactly centered crosswise.

The dowel drill: The best type of drill for dowel work is the popular twist-drill pattern with spurs and brad point. The point should run true so that when rotating, it will seem to stand still and can be centered with hairline accuracy. Drill speed should be 1200 r.p.m. for hardwoods and 2400 r.p.m. for softwoods. Extension spurs on the drill should be short and sharp to eliminate leading or wandering tendency when drilling end grain.

The dowel pin: The dowel pin itself is usually birch or maple and is purchased ready made. Specify a spiral, grooved pattern, which has the best holding power. The diameter of the pin should be one third to one half the thickness of the work —never less than one third. As a large percentage of all work is ¾-in. stock, the ⅜-in. dowel is the size most used. The length should be five or six diameters for average work. Thus, a ⅜-in. dowel should be 1¾ or 2 in. long, and either of these stock sizes can be used for most jobs. When smaller or larger diameters are needed in small quantities, the dowel pins can be made from standard dowel rod. Cutting-off to length is done on the bandsaw, Fig. 22. If a spiral groove is desired, it can be cut very neatly by tilting the bandsaw table 15 or 20 deg., and then pushing the rod into the blade against a clamped fence, as shown in Fig. 23. The dowel rod will feed







Dowel Pins

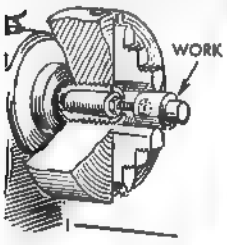
Dowel pins may be purchased, but odd sizes can be turned in short lengths on lathe. The photos show way of mass-cutting pins to length and spiraling on bandsaw. The glue groove, running lengthwise, is produced on bench saw

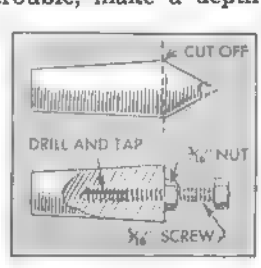
itself and requires only a slight hold-back hand pressure to prevent over-running. While the spiral groove is not essential, some kind of grooving should always be used to provide an outlet for excess glue. The straight groove is easily run with the saw setup shown in Fig. 24.

Gluing: Any cabinet glue, hot or cold, is satisfactory for doweled joints. A small dowel is used to put glue into the hole, and the dowel itself is dipped half its length into the glue. If the joint is not to be assembled immediately, any excess glue should be wiped off. If the joint is to be assembled immediately, the small dowel stick is used to spread glue in the second hole and over the projecting part of the dowel. Then, the joint is pressed together and clamped. Slight countersinking of dowel holes, as shown to the left of Fig. 3, is a good idea and is intended to provide a recess for excess glue.

Depth Stop for Engine-Lathe Chuck Made From Tailstock Center

Work being turned on an engine lathe frequently will push back into the chuck. To eliminate this trouble, make a depth stop from an old tailstock center. The point of the center is cut off as shown. Then the center is drilled and tapped to take a 5/16-in. machine screw. The screw is inserted in the center, and a nut is used to lock it in position. After adjusting the screw so that the work rests firmly against the head, place the assembly in the lathe chuck.

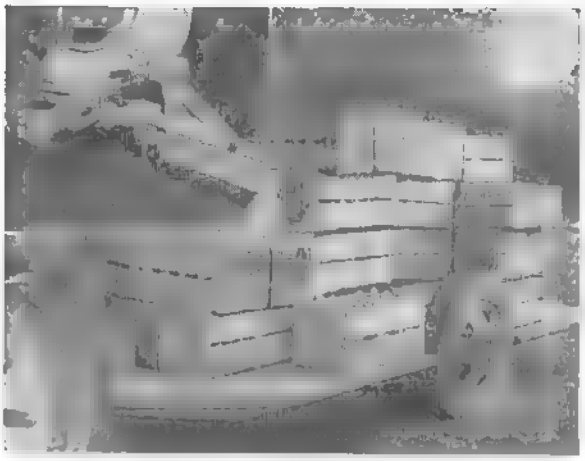




¶To remove transfers from walls, lay a wet cloth over them and then apply heat with an electric iron. After the transfers are softened, they are scraped off.

This Low-Lift Platform Trailer Hitches to Your Tractor or Truck

In addition to being well suited for moving heavy farm machinery on the road or from field to field, this trailer is especially handy for hauling fruit from orchard to packing house. Freshly picked fruit must be handled carefully by hand, whether it is sacked or packed in crates, and the wide trailer platform, underslung only a few inches above the ground, makes it easy to lift and stack the fruit for hauling. A multiple hitch consisting of two clevises welded to the drawbar, one directly above the other as in the inset photo, permits hitching the trailer to either a tractor or truck. By using a welded axle of channel iron, the width of the trailer can be built out to the maximum allowed on the highway.

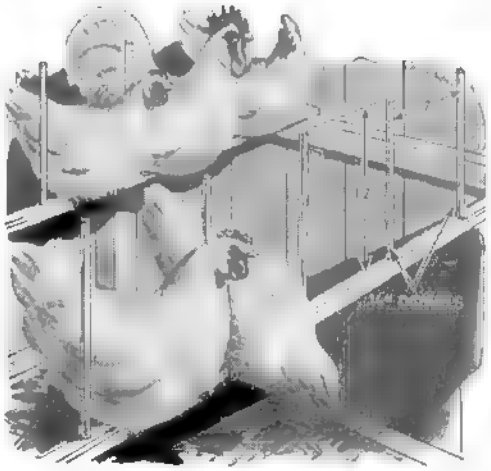


Red Core in Car-Battery Post Identifies Positive Terminal

After noticing that the negative and positive terminal markings on rental batteries soon became defaced and thereby confused customers who often installed the batteries themselves, one garage attendant permanently identified the positive post of the battery in the following manner: First, he drilled a ¼-in. hole down through the center of the positive post, about ½ in. deep. He was careful not to drill all the way through the post. Then he melted the lead drilling chips from the hole and colored them with a small amount of dry red lead. After this he poured the lead back in the hole in the post. This formed a permanent colored core that cannot be destroyed by the points of a tester or by repeated clamping of battery cables.

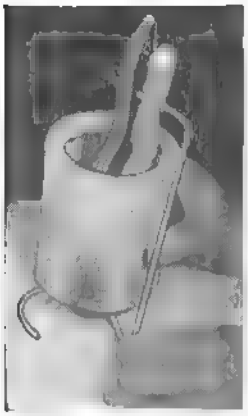
Roosts Divided Into Stalls Prevent Crowding

Nearly every poultryman has trouble at times with individual birds in his flock who crowd others from pole-type roosts. One poultryman has found that dividing the roosts in the manner shown helps prevent this trouble. Simply drill holes about 7 in. apart and insert 12 in. lengths of ½-in. dowel stock. The dowels will effectively keep the birds separated and provide each with an equal amount of roosting space.



¶When cutting a stencil on a typewriter, errors will be easy to locate if a piece of carbon paper is inserted between the stencil and its cardboard backing so that the copy will be reproduced on the cardboard.

Holder Suspends Paintbrushes In Cleaning Solution



When paintbrushes are set in a can of cleaner to keep them from hardening between jobs, the bristles may become bent out of shape. A simple holder to keep the bristles off the bottom of the can may be bent from a piece of heavy wire. The can sets on the lower end of the holder.

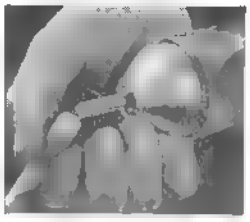
Grip of Paper Clips Improved By Rubber Coating

If you have experienced trouble in having paper clips slip, especially when used on a stack of papers that is a little too thick, try coating them with a film of rubber. To do this, merely dip them in rubber cement, white rubber tire coating or even tire-patching cement. This will leave a film of rubber on the clip, which when dry, provides a non-slip surface on the clip.

Spring Restores Oilcan Action

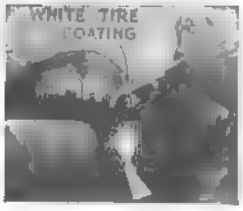
An oilcan of the type pictured may wear so that the bottom will not snap back into place when pressed to force out the oil. However, you can restore the snap action with a spring. Cut off a piece of old screen-door spring and stretch it to produce a compression spring. Insert one end into the lower end of the spout. Then, when the spout is screwed onto the can, the lower end of the spring will press on the bottom of the can. Length of the spring will depend on the depth of the can and the distance the spring slips into the end of the spout. If the spout is too small to take a screen-door spring, any compression spring, or a tension spring that has been stretched, that will just enter the lower end of the spout will do.

Miniature Spur Center Is Handy For Turning Small Work



This tiny spur center, which can be held in a drill chuck in the wood lathe, is useful for driving small work such as dowel stock, ship-model masts, yardarms, arrow shafts and other turnings too small to be driven by the regular spur center. To make it, first drill a ⅛-in. hole in one end of a 2-in. length of ⅜-in. steel rod. Shape the spurs with a triangular file, cutting two deep notches across the drilled end of the rod. Then grind one end of a short length of ⅛-in. drill rod to a sharp point to make the center pin. Force this into the hole drilled in the end of the spur center with the pointed end projecting about 1/10 in. beyond the edges of the spurs.

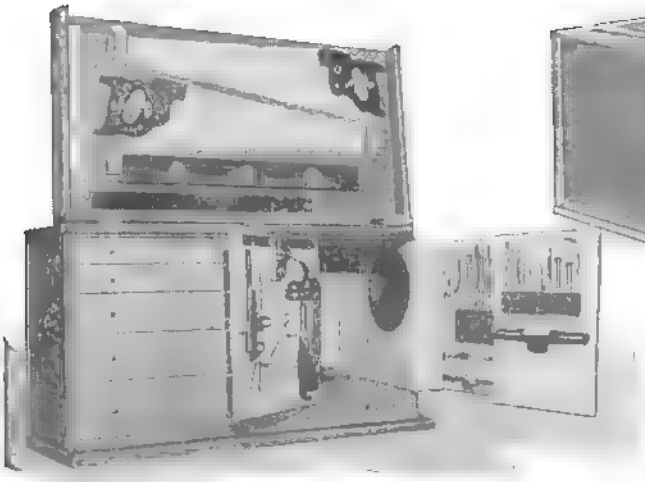
Tire Coating Identifies Toys

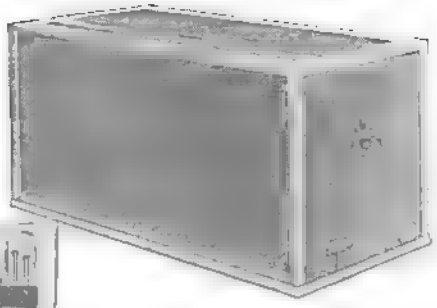


There will be less chance for misunderstandings among small children in your home if each of their rubber toys are identified with the owner's name or initials. You will find that white rubber tire coating is ideal for applying lettering to such articles as the rubber ball shown in the photo.

Making Bottles Shatterproof

If you have bottles of rare chemicals or other valuable materials, especially those in powder or granular form, it is a good idea to wrap the bottles with cellulose tape as indicated. Then, if they are accidentally dropped and broken, the bottles will not shatter and scatter the contents.

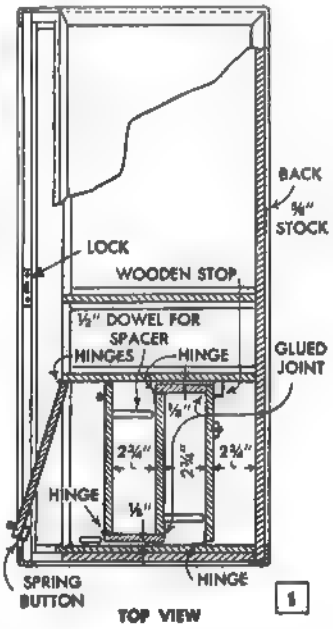




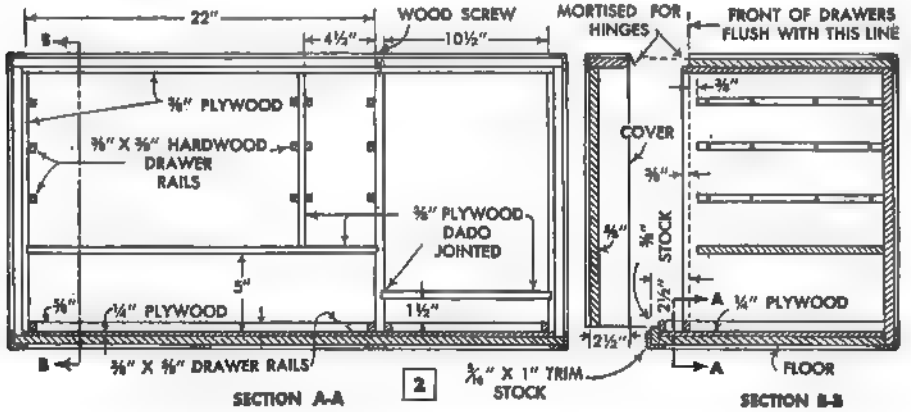
Woodworker's TOOL CHEST

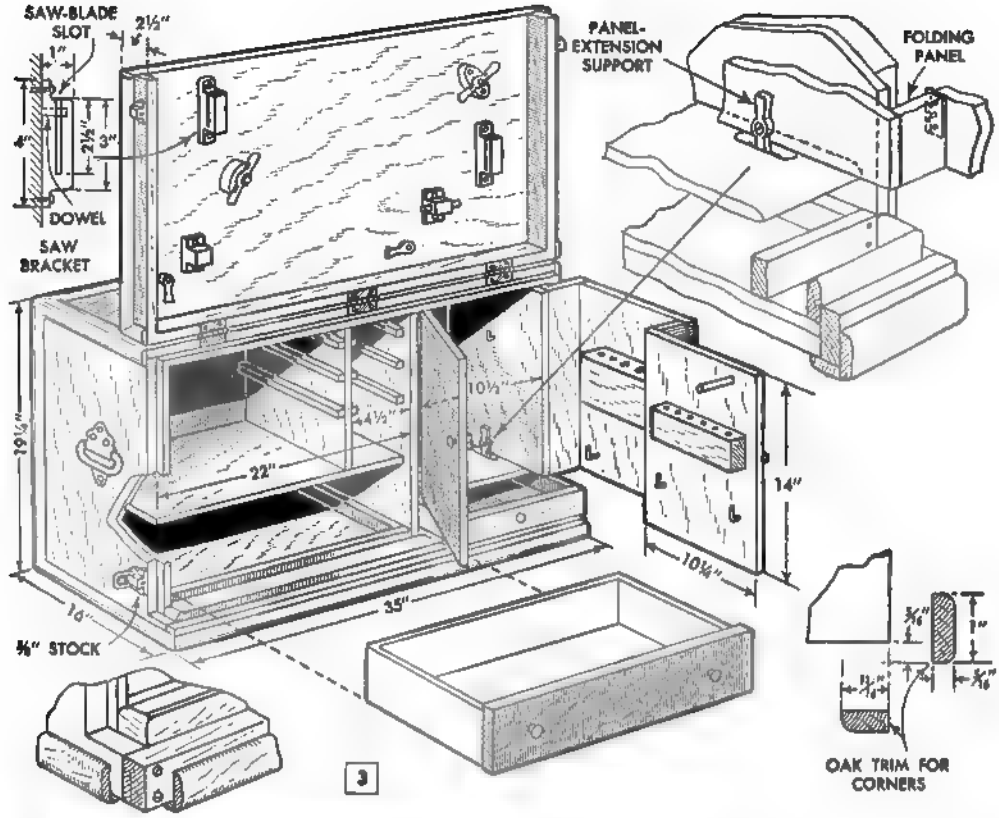
By Edward R. Lucas

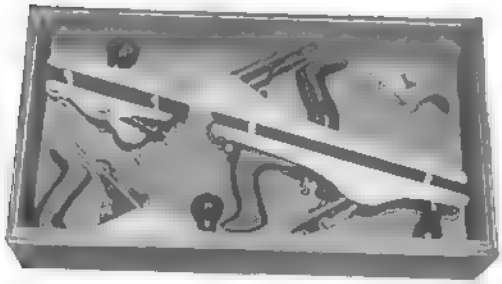
THERE'S a place for each tool and you'll know just where to find it if your woodworking tools are kept in a chest like the one built by Vernon Cutler of Bremerton, Wash. In addition to its convenience and efficiency, this chest conserves workshop space and, if constructed with close-fitting joints and lid, it appreciably retards tool rust. The chest has a spacious drawer for storing planes and other large tools, nine smaller drawers, a tool panel that folds compactly into its compartment, and plenty of room on the inside of the lid for hanging saws, a level and a square. Even the space between the large drawer and chest bottom can be utilized



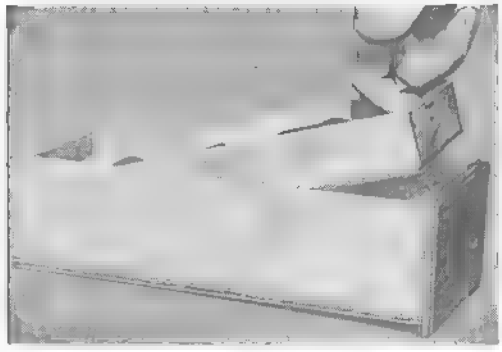
TOP VIEW 1







Above, roomy bottom drawer provides ample storage space for planes or other large tools. Below, drawer inserts permit the number of compartments to be increased without the installation of extra drawers



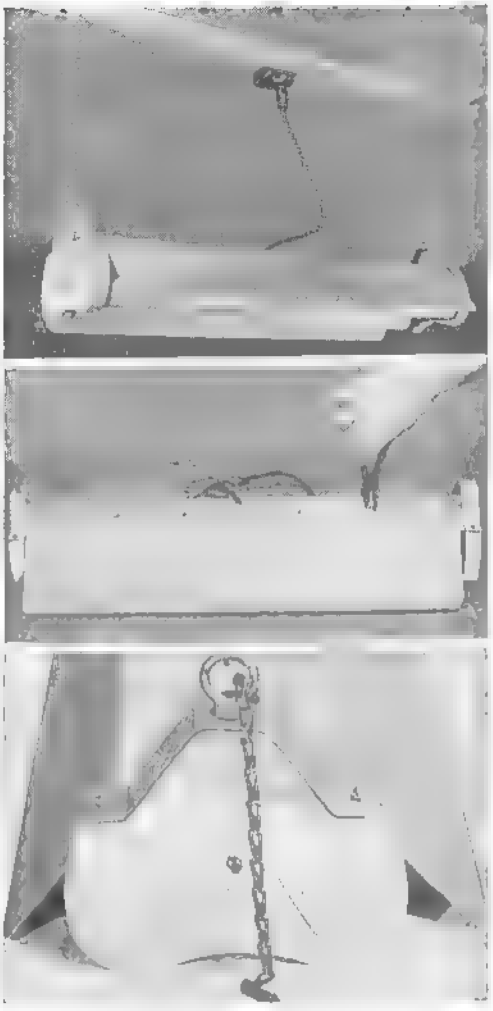
for storing blueprints, magazine plans and pamphlets.

The outer shell of the chest is of cedar with all corners and edges protected by oak trim. The top and sides are lined with ⅜-in. plywood panels and the bottom with ¼-in. plywood. These liners extend ⅜ in. beyond the front edges of the top and sides to form a rabbet for the lid, Fig. 1 and Fig. 2, section B-B. Two ⅝ by 1-in. oak cleats are fastened across the bottom of the chest to give additional support. The vertical partitions and hardwood drawer runners are inserted as in Fig. 1 and Fig. 2, section A-A. All drawer fronts and the door for the tool-panel compartment should fit flush with the chest sides.

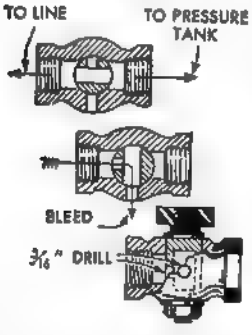
The tool panels are hinged and fitted as in Fig. 1, leaving at least ⅛-in. clearance between each wall of the compartment and the panels when they are folded. Note the wooden stop and the dowel spacers for the panels. The extension support, upper right-hand detail, Fig. 3, holds the tool panels in the open position. The lid is constructed in the same way as the rest of the chest, and is mortise-hinged to the chest top. Fig. 3 shows fixtures for mounting tools on inside of lid.

Fluorescent Ceiling Fixture Converted to Hanging Workshop Light

Wanting a good fluorescent light for his workshop, but hesitating to buy one because of the expense, D. J. Bachner of Jackson Heights, N. Y. converted an ordinary twin-tube ceiling fixture into an excellent workbench and drawing-board light. In addition, the light can be raised to the ceiling to furnish illumination for the entire shop. He first made a sheet-metal reflector to fit over the fixture. This is bent in a U-shape and a hole is cut in it to provide for the lamp cord. Then the reflector is drilled for four small bolts centered and spaced along its length, and the underside of the sheet metal is painted white to afford a good reflecting surface. The overhanging sides of the reflector are bent to come just below the bottom of the fluorescent tubes in order to direct the light downward. When the reflector is finished, the mounting flange is removed from the fixture which is drilled to coincide with the holes in the reflector. Next, a suspension bracket for each end of the fixture is bent from heavy-gauge sheet metal, as shown in the lower photo, and fitted with an eyebolt at the top. Holes are drilled through the legs of the brackets and the end plates of the fixture, and the brackets are bolted to the end plates. After the brackets are in place, the reflector is bolted to the fixture. The fixture is attached to the ceiling by means of screen hooks and lengths of lightweight chain, a method that permits the light to be adjusted to almost any height. As his fixture was of the plug-in type, Mr. Bachner fastened a surface-mounted receptacle to the ceiling near the light. However, if a direct-wired fixture is used, it may be connected to a junction box in the ceiling. A wall switch will be found most convenient.



Bleeder Valve for Pneumatic Tools Improvised From Gas Shutoff Cock



When a two-way air valve is needed to bleed equipment before disconnecting it from an air-pressure tank, one can be made in a jiffy by altering a gas shutoff cock as shown. With the cock in the closed position, insert a drill through one of the threaded openings and make a hole in the side of the cylinder at right angles to the original hole. Then, drill another hole through one side of the valve casting to coincide with the original hole in the cylinder. Use a drill with a diameter approximately one half the width of the valve opening. This will retain ample surface on either side of the holes and prevent air leakage. Thus, a 3/16-in. drill would be used for a valve with a 3/8-in. opening. An extension handle fastened to the top of the valve facilitates operation.

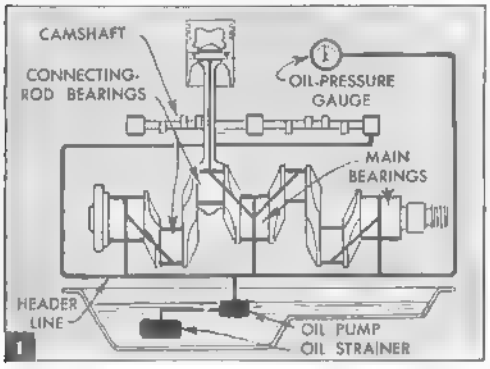
H. W. Billard, Hempstead, N. Y.

Repairing Rust Holes in Car Bodies

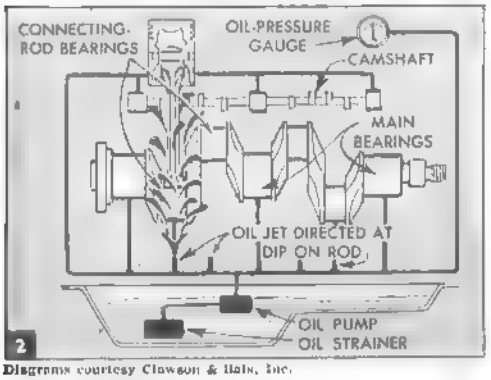
Small rust holes in car bodies can be repaired by plugging them with steel wool, applying flux and soldering. They then can be filed, sanded and painted with metal primer. After the primer has dried, a finish coat of the desired color is applied.

LUBRICATING YOUR AUTO

Good lubrication of the auto engine means more than just adding a quart of new oil occasionally. Like all other common servicing operations, it calls for scheduled attention to important details



In a full-pressure oil system, oil is pumped directly to the crankshaft and connecting-rod bearings; also to the camshaft and piston rings. In engines with overhead valves, oil is pumped to rocker-arm shaft



Diagrams courtesy Clowson & Hain, Inc.

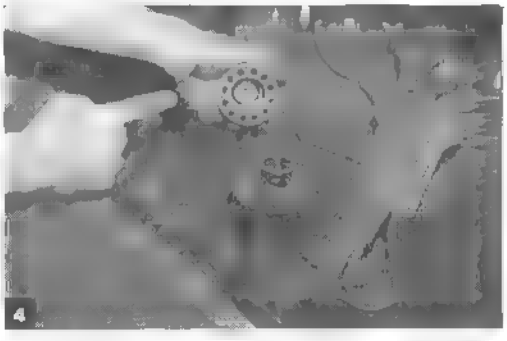
In a modified splash system, oil is pumped to the main bearings and the camshaft bearings. Connecting-rod bearings are lubricated by a splash from oil dips located on the lower ends of the connecting rods

ALTHOUGH good engine lubrication represents only a small percentage of the average yearly cost of operating a car, there is more to it than merely adding a quart of oil now and then. Oil in the crankcase gradually becomes contaminated with certain acids and mildly abrasive particles. Just how rapidly the oil becomes contaminated to a point where it is injurious to the engine and should be replaced, depends much on the driver—length of trips, choking, etc.—and on atmospheric conditions. In some cases it may be possible to drive as much as two or three thousand miles without changing oil, while in other cases it may be advisable to change at 500 miles or less.

For example, in a car that is driven only a mile or two at a time in winter, such as on shopping trips, moisture condenses inside the crankcase each time the motor cools, some of it reaching the oil. Combustion gases passing the pistons mix with the moisture and form a mild sulphuric acid, which pits the bearings, pistons and cylinder walls.

An oil filter does not remove moisture, acid or gasoline. It will remove most solid contaminating and abrasive agents, such as dust, metal and rust particles from the engine, gummy residues from leaded fuels, etc. However, even with an oil filter and a carburetor air cleaner, the oil should be changed at regular intervals, length of the intervals being determined by the operating habits of the driver, distances the car is driven regularly, season of the year and condition of the roads on which the car is operated most of the time.

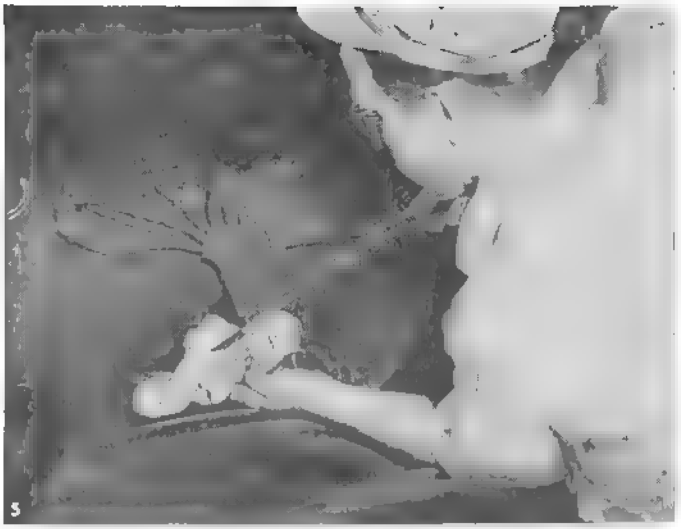
When driving, glance at the dash gauges to see that oil-pressure and temperature readings are normal



Wash breather cap in gasoline at regular intervals. Then coat the element with a heavy motor oil

ENGINE

By Phil Ruskin

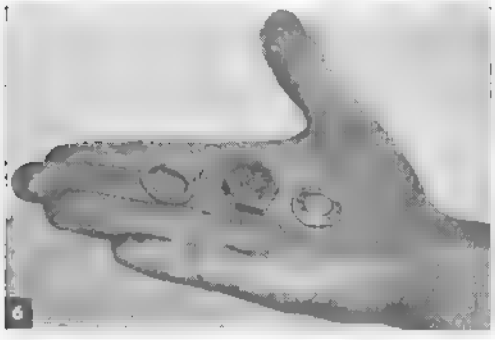


Check the oil level frequently and refill. When checking the oil level after a long drive, wait for the oil to drain back into the oil pan to get the true reading. If the oil appears discolored or if there are indications of water, drain, flush and refill with new lubricant

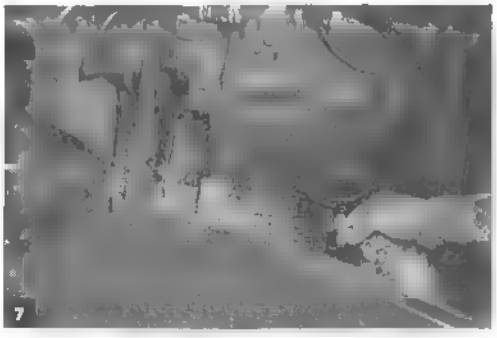
One method often suggested for determining oil-change periods is to test the oil for contamination, especially acid content, at regular intervals over a period of time, and from this data work out an oil-changing schedule for both winter and summer.

A lubricating oil has to perform several separate jobs in protecting the engine from excessive wear. It must lubricate moving parts and reduce friction to a minimum, Figs. 1 and 2. The oil also acts as a coolant in carrying off heat from the cylinders and the bearings. In addition, it seals engine compression by providing an oil film between the pistons and the cylinder walls. Some oils also act as cleansing agents by removing dirt and carbon from the working parts of the motor.

Always use a high-quality motor oil of the correct viscosity for the particular engine, selecting it according to the type of operation and season of the year. Oils are now available for various kinds of operating conditions. Usually these are designated as regular, premium and heavy-duty grades. The regular-type motor oil is satisfactory for average use in a passenger car. However, regular grades do not ordinarily contain oxidation inhibitors (additives) which aid in preventing sudden breakdown of the oil under exceptionally severe operating conditions. For constant hot-running conditions, such as mountain travel and long runs in summer heat, where motor oil tends to break down rapidly, a premium-type oil should be used. This contains a chemical (additive) which resists breakdown of the oil by oxidation, thus preventing undue sludge formation and bearing corrosion. Heavy-duty motor oils contain not only additives, but also detergent agents which cleanse the engine parts of solid deposits and tend to keep sludge dissolved in the oil. Generally, this special grade is required only for trucks and other heavy-duty engines, but it can be used in passenger-car engines subjected to severe operating conditions. When using these special oils for the first time, the crankcase should be drained after 300



A leaky drain plug may cause complete loss of oil from the crankcase, resulting in a damaged engine



Use a light oil for the generator, starter and other units having oil cups, but do not overlubricate

Lubricate distributor shaft with high-temperature grease. Take care not to get dirt in the grease fitting

to 500 miles, as the first filling will rapidly collect crankcase waste and sludge. It is not advisable to mix different kinds of premium lubricating oils.

For best results, engine operating temperatures should never be lower than 140 deg. or more than 180 deg. F., and preferably should be between 160 and 180 deg. F. The proper operating temperature is important as it affects the efficiency of the lubricating system. Clean the cooling system regularly of rust and other loose deposits by a thorough back flushing. A loose fan belt may cause overheating and overloading of the cooling system. If the engine runs too cool in cold weather, cover a portion of the radiator. When starting a cold engine, remember that most engine wear takes place during the warming-up period, especially if the engine is raced idle or put under load immediately after starting. When temperatures are below 70 deg., it is good driving practice to allow the engine to warm up before driving the car. After stopping, oil drains rapidly from the working parts when the engine is warm and because of this the bearing surfaces will be relatively dry when the engine is started again. These bearing and sliding surfaces run dry until oil from the pump reaches them. The small quantity of oil left on the bearing surfaces will not stand up under heavy loads or high speeds. Be sure that the automatic choke is working properly as a rich fuel mixture causes dilution of the crankcase oil.

Poor crankcase ventilation, especially in a cold-running engine, will cause extra condensation of water in the crankcase. Short runs in cold weather aggravate this condition. Check and clean the crankcase ventilator openings, Fig. 4, at regular intervals. Wash the filler cap in gasoline and then reoil. An efficient oil filter is helpful in maintaining a clean oil supply, provided the filter element is replaced regularly. However, a filter does not eliminate the need for a regular oil drain; it simply permits the extension of time between drainings. Always renew the filter element when changing to a premium grade of oil. An oil that looks clean may contain too much acid and fine abrasives for safe lubrication. Only a complete draining, flushing and oil renewal will provide adequate protection.

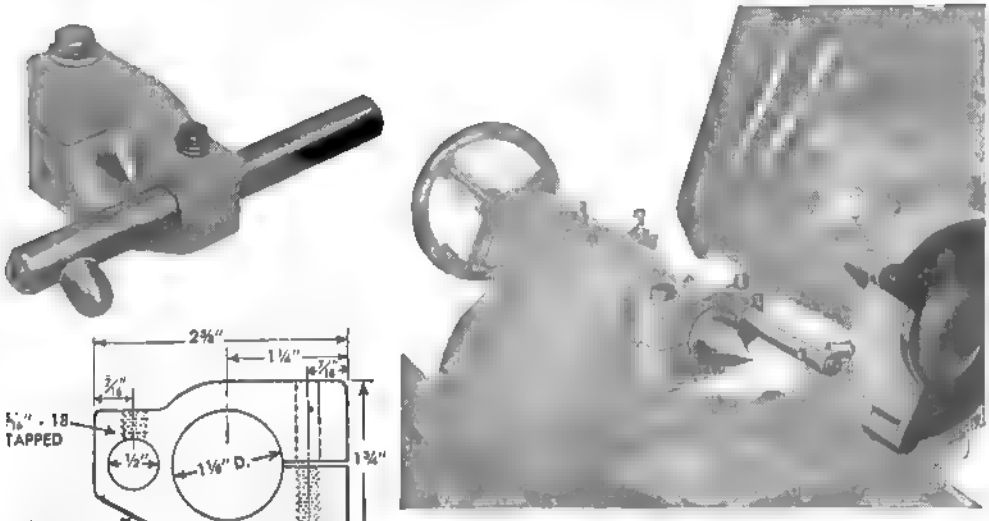
As the cost of a complete oil change is small compared to the yearly bill for gasoline, repairs, storage, etc., it pays to drain and flush the engine oiling system at least twice a year—spring and fall. Without an efficient filter, draining should be done more often. Because some oil remains trapped in the oiling system when draining, flush the crankcase at each draining. Use a flushing oil, which has the properties of a light lubricant, to eliminate any danger of the bearings running dry during the flushing process. Always drain the oil when hot and be sure the drain plug is replaced tightly. See that the plug gasket, Fig. 6, is in good condition. Check the oil level, Fig. 5, after the engine has run awhile. Remember that the filter takes about a quart. When checking the oil level, allow time for the oil to drain back to the crankcase to get an accurate reading. In both new and reconditioned engines, a light-grade lubricating oil should be added to the gasoline for upper-cylinder lubrication. Too heavy an oil may foul the plugs and cause extra deposits of carbon and gum around the valves, pistons, etc.

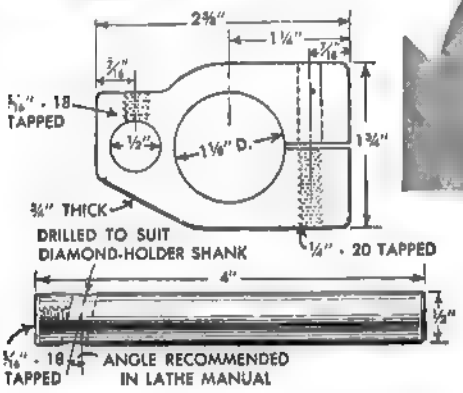
Generator and starting-motor bearings, Fig. 7, if provided with oil cups, require a few drops of light motor oil at regular intervals. Clean the cups before oiling to prevent dirt getting into the bearings. Do not overlubricate. Use a high-temperature grease in the distributor-shaft grease cup, Fig. 8, and put a few drops of oil on the felt pad under the rotor. A light smear of grease on the rotating cam face will save wear in the breaker assembly. Water-pump lubrication varies, and some have bearings that do not require lubrication. Use a medium oil in the water-pump oil cups and a special water-pump grease in the grease cups. This grease will resist heat and the dissolving action of water. As with all moving parts, do not overlubricate the water pump.

The fans on some engines require separate lubrication. Use a small amount of chassis lubricant for fans having pressure-type fittings, and a motor oil for those having sump-type lubrication.

If your car won't start due to the ignition system being wet, try sprinkling carbon tetrachloride over the distributor, coil and spark plugs. This usually will permit the motor to be started immediately.

Grinding-Wheel Dresser Rides Lathe Tailstock





Designed to clamp on the tailstock spindle and support a diamond-tipped grinding-wheel dresser, this handy lathe attachment is especially useful in truing wheels on a tool-post grinder. Mounted in this manner, the dresser can be left undisturbed in any set position to maintain the same wheel-to-work angle each time the wheel requires dressing.

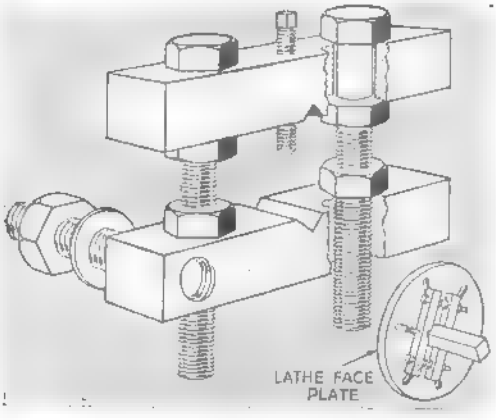
The attachment consists of a simple clamp-type holder which can be a casting or machined from ¾-in. steel or brass plate. In either case, the holder is chucked and lathe-bored to fit over the tailstock spindle, the lathe shown requiring a 1⅛-in. hole. Then a slot is made in from the edge to meet the hole. This permits take-up on the holder when clamping it to the spindle with a cap screw. Note that the slotted end is counterbored for the screw with a clearance hole in the upper half and a tap hole in the lower.

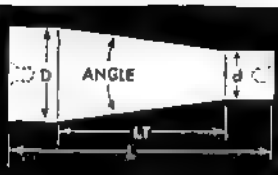
The extension arm is ½-in.-dia. cold-rolled steel and is locked in the holder with a socket-headed setscrew. The angle of the hole which is drilled crosswise through the arm to receive the shank containing the diamond tip, can be 15 to 30 deg. This is not critical, although the type of diamond tip used determines the amount of angle necessary to permit rotating the tip to expose a new cutting edge when the diamond wears. The end of the arm is drilled and tapped for a socket-headed setscrew which locks the shank of the diamond tip in place. In use, the wheel is moved past the diamond dresser.

Driving Dog for Faceplate Work

To simplify and speed the operation of mounting and driving duplicate work on a lathe faceplate, I made this simple driver to replace the regular faceplate dog. It is bolted to the faceplate and has two adjustable jaws to accommodate both round and square stock of various sizes. Once adjusted to suit the work at hand, the driver permits subsequent pieces of work to be chucked rapidly merely by inserting between the jaws and clamping with a lock screw. The jaws are of square cold-rolled steel, V-notched, drilled and tapped for two cap screws and the locking screw.

Francis McCartin, Schenectady, N. Y.





TAPER TURNING

TO FIND SETOVER

1. T.P.F. GIVEN:
   FIND NEAREST T.P.F. IN COL. 1. READ SETOVER FACTOR ON SAME LINE, COL. 4. MULTIPLY FACTOR BY TOTAL LENGTH OF WORK (L).
2. TOTAL ANGLE GIVEN:
   FIND NEAREST ANGLE IN COL. 2. READ SETOVER FACTOR ON SAME LINE, COL. 4. MULTIPLY FACTOR BY L.
3. DIAMETERS AND LENGTH GIVEN:
   APPLY THIS FORMULA TO FIND TAPER PER INCH:
   $$T.P.I. = \frac{D-d}{LT}$$
   THEN, FIND NEAREST T.P.I. IN COL. 3. READ SETOVER FACTOR IN COL. 4. MULTIPLY FACTOR BY L.
4. PROPORTIONAL TAPER:
   A TAPER SPECIFIED, FOR EXAMPLE, 1 IN 24, MEANS T.P.I. OF 1/24". LOCATE THIS FIGURE IN LEFT SIDE OF COL. 3, THEN READ SETOVER FACTOR AND MULTIPLY BY LENGTH.

TAPER ATTACHMENT

IF T.P.F. OR TOTAL ANGLE IS GIVEN, SET DIRECT ON TAPER-ATTACHMENT SCALE. IF LENGTHS AND DIAMETERS ONLY ARE GIVEN, CALCULATE T.P.I. AS PER UNIT NO. 3 ABOVE. THEN, LOCATE T.P.I. IN TABLE AND ON SAME LINE READ EITHER T.P.F. OR TOTAL ANGLE FOR TAPER ATTACHMENT SETTING.

COMPOUND SWIVEL

1. T.P.F. GIVEN:
   FIND NEAREST T.P.F. IN COL. 1. READ EQUIVALENT COMPOUND SWIVEL IN COL. 5.
2. TOTAL ANGLE GIVEN:
   TABLE NOT NEEDED. SET COMPOUND PARALLEL WITH LATHE BED; THEN, SWIVEL THROUGH ½ OF THE TOTAL ANGLE SPECIFIED.
3. DIAMETERS AND LENGTH GIVEN:
   CALCULATE T.P.I. AS PER UNIT NO. 3 ABOVE. THEN, FIND NEAREST T.P.I. IN COL. 3. ON SAME LINE, READ EQUIVALENT COMPOUND SWIVEL IN COL. 5.

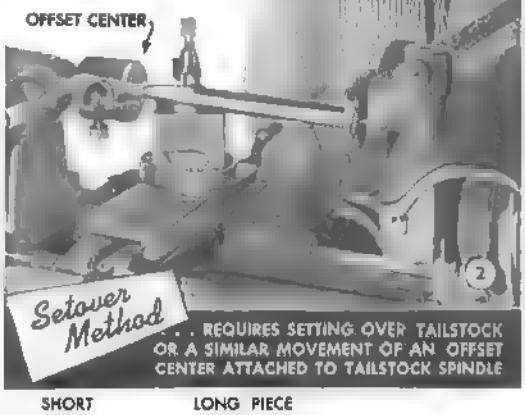
1		2	3		4	5	6
TAPER PER FT.		TOTAL ANGLE	TAPER PER INCH		SETOVER FACTOR	COMPOUND SWIVEL	SPECIFIC USE
Fraction	Decimal		Approx. Fraction	Decimal			
	.006	0° 02′	—	.0005	.0003	0° 01′	Mandrels
1/8	.125	0° 36′	1/100	.010	.0052	0° 18′	
3/16	.187	0° 54′	1/62	.016	.0078	0° 27′	
	.210	1° 00′	1/59	.017	.0087	0° 30′	
1/4	.250	1° 12′	1/48	.021	.0104	0° 36′	Taper Pins
5/16	.312	1° 30′	1/38	.026	.0130	0° 45′	
3/8	.375	1° 47′	1/32	.031	.0156	0° 53′	
	.419	2° 00′	1/29	.035	.0174	1° 00′	
7/16	.437	2° 05′	1/28	.036	.0182	1° 02′	
1/2	.500	2° 23′	1/24	.042	0208	1° 11′	All Brown and Sharpe Except No. 10
	.516	2° 28′	1/23	.043	.0215	1° 14′	Brown and Sharpe No. 10
9/16	.562	2° 42′	1/21	.047	.0234	1° 21′	
	.597	2° 52′	1/20	.050	.0249	1° 26′	Jacobs No. 0
	.600	2° 52′	1/20	.050	.0250	1° 26′	Morse Nos. 1, 2, 3 Jarno (All)
5/8	.625	3° 00′	1/19	.052	.0260	1° 30′	Morse Nos. 0, 4, 6, 7 Jacobs Nos. 4, 5, 6
	.630	3° 00′	1/19	.053	.0263	1° 30′	Morse No. 5
	.637	3° 02′	1/19	.053	.0265	1° 31′	Jacobs No. 3
11/16	.687	3° 18′	1/17	.057	.0286	1° 39′	
3/4	.750	3° 25′	1/16	.062	.0312	1° 47′	Pipe Threads
	.838	4° 00′	1/14	.070	.0349	2° 00′	
7/8	.875	4° 12′	1/14	.073	.0365	2° 06′	
	.923	4° 24′	1/13	.077	.0384	2° 12′	Jacobs No. 1
	.978	4° 40′	1/12	.082	.0407	2° 20′	Jacobs No. 2
1	1.000	4° 45′	1/12	.083	.0417	2° 23′	
	1.047	5° 00′	1/11	.087	.0436	2° 30′	
1-1/4	1.250	5° 58′	1/9	.105	.0521	2° 59′	
	1.257	6° 00′	1/9	.105	.0523	3° 00′	
	1.465	7° 00′	1/8	.122	.0610	3° 30′	
1-1/2	1.500	7° 08′	1/8	.125	.0625	3° 34′	
	1.676	8° 00′	1/7	.140	.0698	4° 00′	
1-3/4	1.750	8° 20′	1/7	.146	.0729	4° 10′	
	1.885	9° 00′	1/6	.157	.0785	4° 30′	
2	2.000	9° 32′	1/6	.167	.0833	4° 46′	
	2.094	10° 00′	1/6	.174	.0872	5° 00′	
	2.310	11° 00′	1/5	.192	.0958	5° 30′	
2-1/2	2.500	11° 54′	1/5	.208	.1042	5° 57′	
	2.513	12° 00′	1/5	.209	.1045	6° 00′	
	2.717	13° 00′	1/4	.226	.1132	6° 30′	
	2.931	14° 00′	1/4	.244	.1219	7° 00′	
3	3.000	14° 16′	1/4	.250	.1250	7° 08′	
3-1/2	3.500	16° 36′	1/3	.292	.1458	8° 18′	Milling Machine

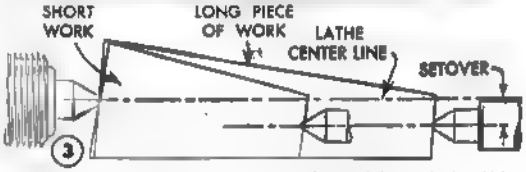
and BORING PRACTICE

By Sam Brown

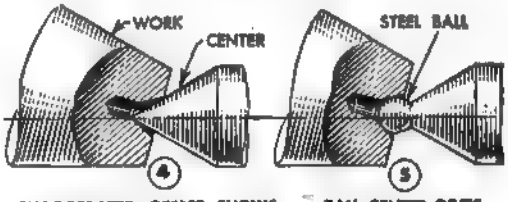
ALTHOUGH taper turning is a common shop operation, it requires a careful setup to produce work accurately to required dimensions. In most shops it commonly is done by one of three methods: (1) Setting-over the tailstock; (2) by use of a taper attachment and (3) by swiveling the compound. Most craftwork and small machine-shop work is done with the setover method. The mechanics of this operation are fairly well understood by most workers, and the main difficulty is not in the work itself but in calculating the required amount of setover. This is simplified by the table on the opposite page, which lists a considerable range of standard tapers. If the job happens to call for a taper not listed, use the next size under the specified taper.

Setover method: Nearly all lathes are equipped with setover tailstocks, the amount of setover varying with the size and type of machine. Although it serves the purpose where only an occasional taper is turned, in production work this system has two faults: First, it requires movement of the tailstock and the consequent tedious adjustment of getting it back to the proper position for straight turning; second, it tends to score the tail center. One good remedy for the first fault is to use an offset center, which is adjustable for setover. A simple type is shown in Fig. 2. Another style with a micrometer sleeve is pictured in Fig. 1. This model has a ball center, Fig. 5, which eliminates the problem of scored centers. Why the work scores the common 60-deg. center can be seen from Fig. 4. This is exaggerated, of course, as the scoring is not bad when cutting medium tapers. However, there is the possibility of an inaccuracy developing while the work is in progress, due to deep scoring of the center



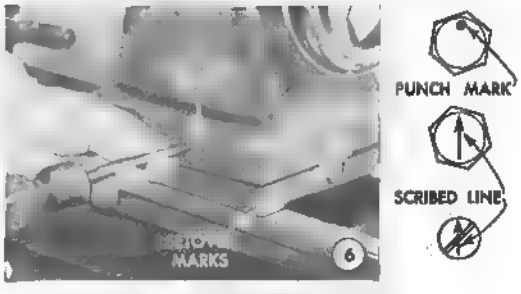


THE SAME AMOUNT OF SETOVER GIVES DIFFERENT TAPERS



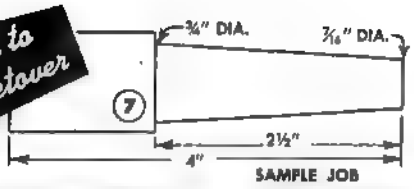
EXAGGERATED OFFSET SHOWS POOR CONTACT OF 60° CENTER

BALL CENTER GIVES BETTER CONTACT



PUNCH MARK OR SCRIBED LINE ON SETOVER SCREWS ASSURES ACCURATE RESETTING OF TAILSTOCK

5 - Ways to Measure Setover

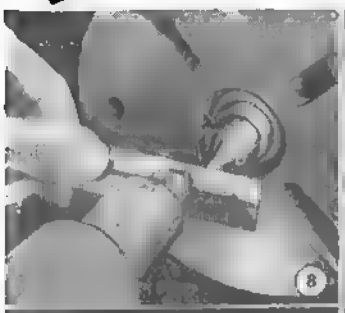


SETOVER CALCULATION

$$T.P.I. = \frac{D-d}{LT} = \frac{.750-.437}{2.5} = .125$$

T. P. I. OF .125 = .0625 SETOVER FACTOR
(THIS FROM TAPER-TURNING TABLE)

THEN: .0625 X 4 = .25" SETOVER

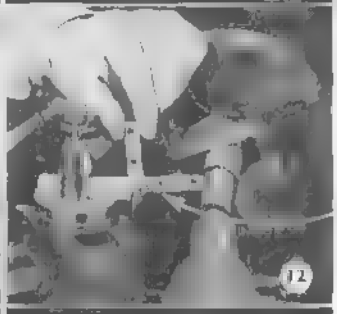


1 BY MEASURING AT CENTERS

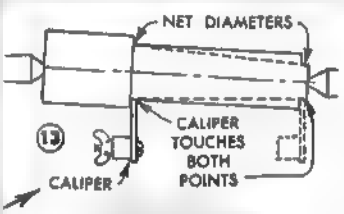
2 DIRECT DIAL READING

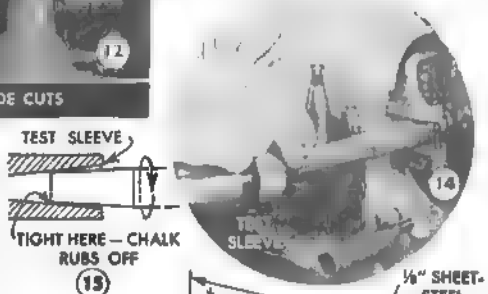
3 READING MICROMETER SLEEVE

4 SET TO DUPLICATE TAPER

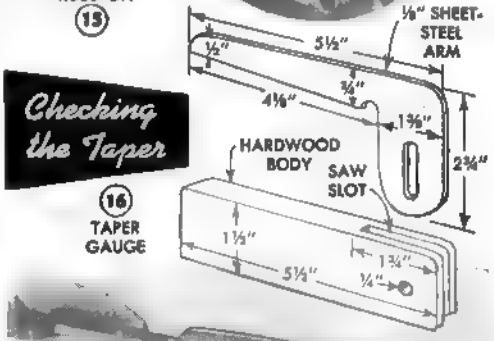


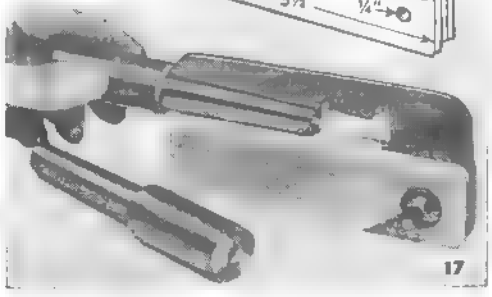
5 SET TO GUIDE CUTS





Checking the Taper



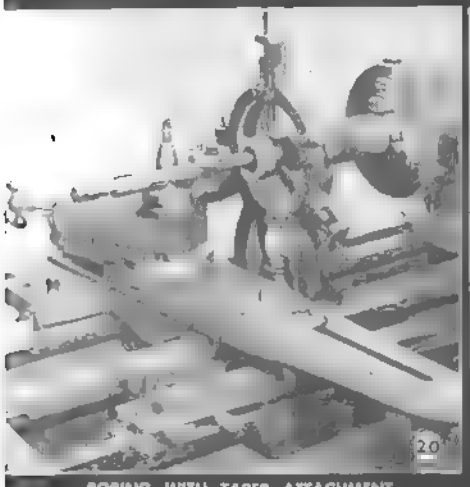


or, in some cases, the work. Another simple way to eliminate this trouble is to use a ball-bearing center instead of the plain type. When the tailstock itself is set over, resetting is made easier if the setover screws are indexed. By punch-marking the adjusting screws as in Fig. 6, you can easily readjust the centers to the parallel position after turning a taper.

The main point in setover taper turning is that the over-all length of the work always determines the setover. The taper can be part or full length, at either end or at the center, but the amount of setover depends on over-all length. Fig. 3 shows how the same amount of setover produces different tapers on different lengths of work. If the work is mounted on a mandrel, the setover is calculated from the length of the mandrel, not the length of the work. For external cutting, the setover usually is made toward the operator; internal cuts are made with the setover away from the operator. The tool bit must be exactly on center, as inaccurate work will result if the cutting point is above or below center.

Five ways to measure setover: Figs 8 to 12 inclusive show five ways to measure the

SETTING TAPER ATTACHMENT FOR 1" PER FOOT TAPER



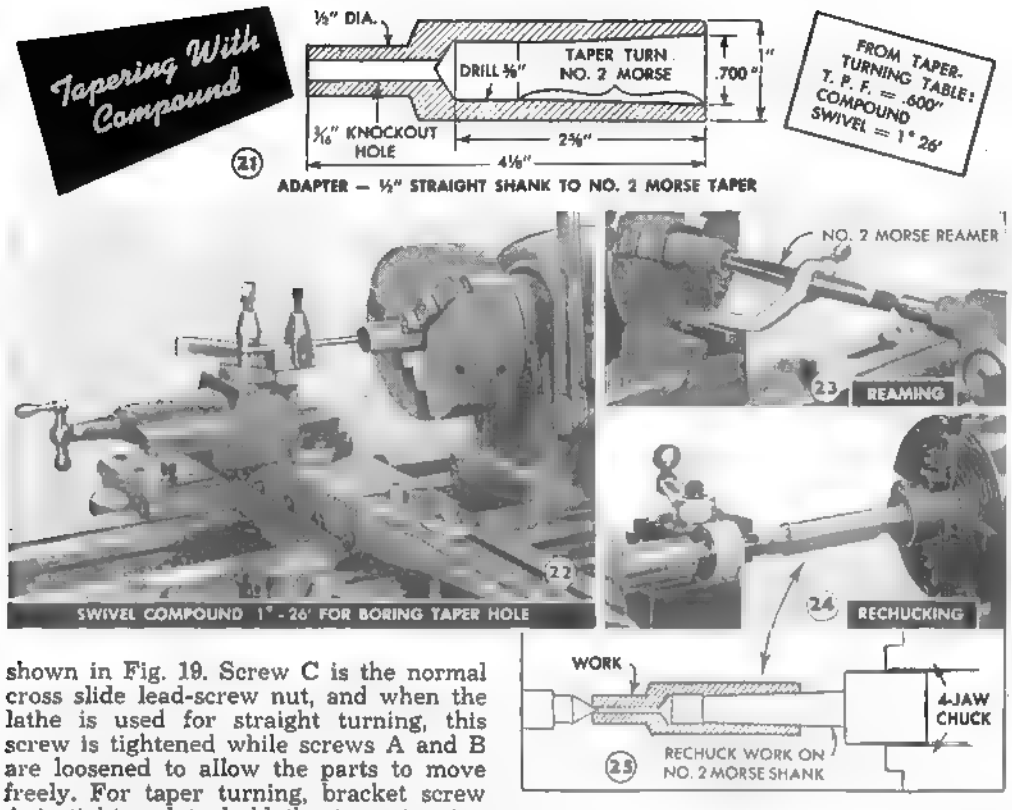
BORING WITH TAPER ATTACHMENT

Taper Attachment . . . FURNISHES BEST WAY OF DOING TAPER TURNING, EITHER INTERNAL OR EXTERNAL. THE DEVICE IS A PERMANENT PART OF THE LATHE.

tailstock setover. These are numbered 1 to 5 inclusive. A sample job, Fig. 7, is used to illustrate. However, when work is specified in this way, it is practical to make the setover without calculation, using the method shown in Figs. 12 and 13. In this method, the body of the taper is turned to the net diameter at the big end, and a shoulder cut is run in at the small end to the small-end diameter to give a second measuring point. Now, if the tailstock is offset so that the two measuring points are equidistant from the parallel line of carriage travel, the longitudinal carriage movement consequently will cause the tool to cut the taper as specified. This can be seen in Fig. 13. Method No. 4, Fig. 11, is another system of direct setting without calculating the setover. This requires a duplicate taper which is mounted between centers. Then the tailstock is set over until the tool point follows the taper. Now, if the workpiece is made the same length as the sample, the taper cut will duplicate the sample. Methods 1, 2 and 3 are measuring methods from a calculated setover. No. 2 is the most exact and simplest; No. 1 is fast but rough; No. 3 is the method most commonly used. In this last method, the calculated amount of setover is read on the cross-feed micrometer sleeve. In order to take out backlash in the screw, the reading should be made as follows: Run the flat end of the tool holder lightly against a strip of paper held over the tailstock spindle, as shown in Fig. 10. Now, back up the feed until the paper can be pulled free. Take the micrometer reading from the sleeve and back off the calculated amount of setover. Then, with the tool remaining in this position, the tailstock is set over until it clips the paper with the same "feel" as before. In any case, do not overrun the setover—set it light and take a sample cut preparatory to checking.

Checking the taper: If a test sleeve is available, the work is tested by chalking the turned portion, Fig. 14, and then rotating the work inside the sleeve. Fig. 15 shows the small end of the work oversize; more setover is needed. This is the correct way to proceed—gradually coming down to size with a series of cuts. Testing should begin as soon as you have about 1 in. of tapered surface. Figs. 16 and 17 picture one of many types of taper gauges. These are often handy, but must be accurately made to be useful.

Taper attachment: The best taper attachments are specially-made fixtures permanently attached to the lathe, just like the gear box or carriage. A typical unit is

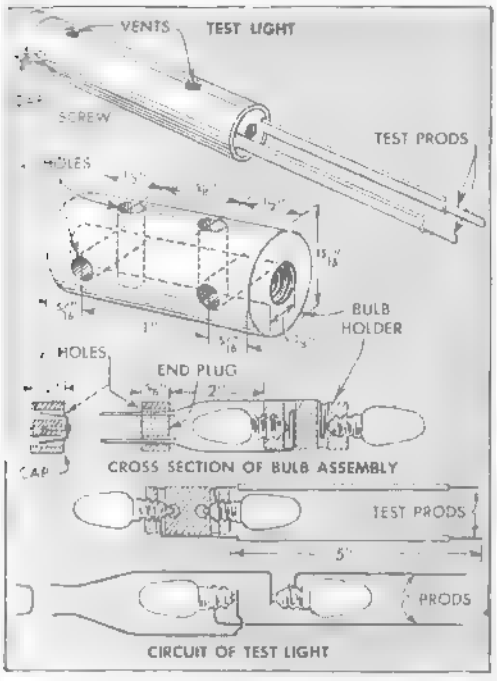


shown in Fig. 19. Screw C is the normal cross slide lead-screw nut, and when the lathe is used for straight turning, this screw is tightened while screws A and B are loosened to allow the parts to move freely. For taper turning, bracket screw A is tightened to hold the taper-turning unit in a fixed position. Lead-screw nut C is loosened, releasing the cross-feed. Screw B is tightened, and this ties the free cross slide with the slide bar of the taper attachment. The taper-per-foot is set by swinging the pivoted taper bar until the index mark on the end of the bar reaches the correct reading on the fixed scale, Fig. 18. A taper attachment has many advantages: It is not necessary to set the tailstock over or to measure the amount of setover; the same taper can be cut on work of any length; work can be mounted in the chuck, and internal cuts, Fig. 20, are just as easily made as external cuts.

Tapering with compound: Lacking a taper attachment, internal taper cuts are usually made with the compound-slide hand-feed. A sample job is shown in Fig. 21. The feed of the average compound slide is 2 to 2½ in., so instead of boring the full length of the taper, a short distance at the bottom is bored straight with a suitable tool. The remaining distance is then within the travel of the compound, and also is sufficient for accurate fitting and practical use. Since this sample job is a No. 2 Morse taper, the compound swivel is 1 degree and 26 minutes, which is just a little under 1½ degrees. Set the compound parallel with the lathe bed, and then swivel it the 1½ degrees required. It is a good idea to check the parallel position first, since the compound scale cannot always be relied on for this purpose. Fig. 22 shows the cut being made, using a ¼-in. boring bar.

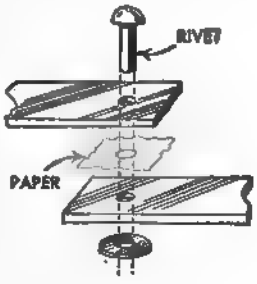
Reaming a taper: Accurate boring with the boring tool alone can be done, but if you do much of this work it is better to finish with a taper reamer. Using the reamer, the hole need only be rough-bored, and then finished with a light reamer cut, Fig. 23. In this operation, the work should be flooded with oil, should run at lowest lathe speed and the feed must be slow and even to prevent jamming or "freezing." When doing this type of reaming, especially where considerable stock is to be removed, it may be necessary to withdraw the reamer at short intervals to clear it of chips. If the flutes fill with chips this may cause the reamer to freeze with possible scoring of the work. The outside of the sample job is finished by mounting on a No. 2 Morse chucking fixture or any kind of shank having a No. 2 Morse taper. The operation is shown in Figs. 24 and 25. If desired, the procedure can be reversed, turning the outside first and then centering in a 4-jaw chuck for the taper cut.

Electrician's Test Light Built From Stock Parts

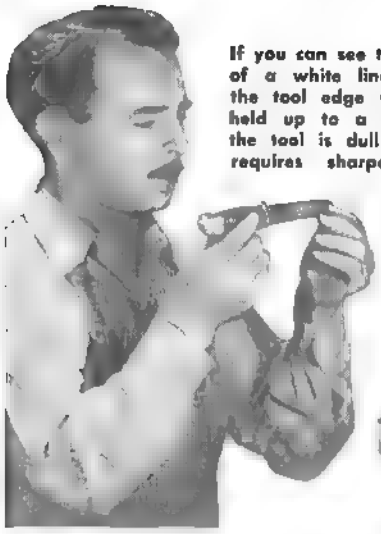


In addition to the regular flexible prods for locating defective fuses and open circuits, this test light has a novel and useful feature. A removable end cap allows the light to be plugged into a 110-volt outlet, either a wall receptacle or an extension cord, for testing fuses and locating grounds or open circuits in electrical equipment without danger of grounding the source of power. The housing is made from a length of fiber tubing and the bulb holder is a round piece of wood cut from a shade roller. Two 110-volt candelabra-base bulbs are used. With care these can be turned into the holes in the ends of the bulb holder to form their own threads. The end plug supporting the plug prongs and cap can be cut from the same wooden stock as the bulb holder. Contact strips for the whole assembly are made from 1/32-in. spring-brass strips, 1/4 in. wide. After assembling and wiring the parts, the assembly is forced into the fiber holder. Slip the end plug over the plug prongs and close the opposite end of the holder with a fiber disk notched to provide openings for the test prods. The cap is fitted with a bent strip of metal held in place with a small brad, as shown in one of the sectional views. A disk of thin fiber is glued to the outer face of the cap to cover the small holes drilled in the cap to take the ends of the strip. When the cap is in place, the metal strip closes the circuit between the two prongs so the unit may be used to locate defective fuses and open circuits in the usual manner. Removing the cap and plugging the tester into a receptacle on the end of an extension cord allows the user to test grounded motors and other equipment for open windings and circuits without danger of grounding the "live" side of the circuit, as one lamp is in each lead. With the prods touching, both lights will be on at half brilliancy. However, contact with a grounded circuit will cause one light to be extinguished while the other reaches full brilliancy.—T. W. Benson, Philadelphia, Pa.

Smooth-Working Pivoted Joint



If you wish to obtain a smooth-working pivoted joint when riveting two parts together, this may be accomplished merely by inserting a small piece of paper between the parts before riveting. After the joint is riveted, the paper is removed, allowing sufficient clearance for the parts to pivot freely.—F. Tashiro, Seattle, Wash.



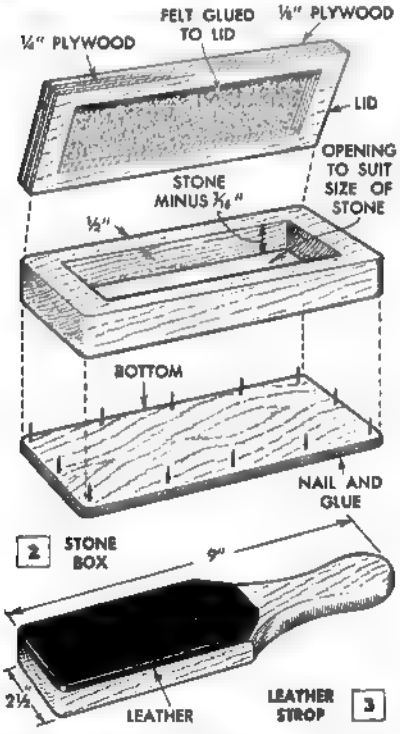
If you can see traces of a white line on the tool edge when held up to a light, the tool is dull and requires sharpening

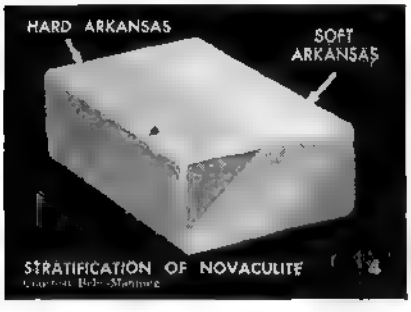
HONE TOOLS

By Sam Brown

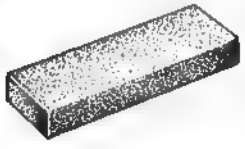
UNLESS there are nicks in the cutting edge, it's not necessary to grind a tool each time to sharpen it. Once ground, any tool can be kept razor sharp for many hours of use by frequent, light honing. The right stone to use in honing depends upon the type of tool and its purpose. Grass and bread knives cut best if honed on a coarse stone, while most other tools require honing on a medium or fine stone to prevent the edge from tearing the work and to hold up under cutting pressure.

Artificial abrasives, aluminum oxide and silicon carbide, are gradually replacing natural or mined stones for honing tools. Aluminum oxide is of the same physical structure as natural corundum and is often called "India." In this country, Arkansas is about the only natural oilstone





5 NATURAL STONES



HARD ARKANSAS — finest grit of all natural stones. Excellent for all delicate cutting edges

SOFT ARKANSAS — softer and more porous than hard Arkansas but cuts considerably faster

LILY-WHITE WASHITA—a soft but fast-cutting stone with good bite. Best for carpenters

Above, new stone should be soaked in oil before using and then always used with oil to prevent wearing unevenly

Right, if continued use produces hollow in the stone, rub the stone on smooth glass, using silicon carbide and water

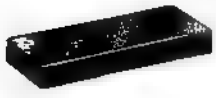
WITH THE RIGHT STONE

of commercial importance. This stone is mineral novaculite, and is largely composed of silica. The stratification of novaculite, Fig. 4, runs from hard Arkansas to soft and then grades off to the still softer and more porous lily-white Washita, Fig. 5. First-grade Washita is the same as lily-white, but is not graded for color.

The bench oilstone: The conventional combination coarse-fine oilstone is widely used in sharpening most straightedge tools in the home shop, although Fig. 1 shows several other shapes which are recommended for honing special tools. The combination oilstone usually consists of either aluminum oxide or silicon carbide. Artificial stones are graded coarse, medium and fine—150, 240 or 320 abrasive grains per inch. Natural stones are not graded by grit size, but by the variety of stone itself. Hard Arkansas, for example, is of both hard and fine texture, whereas soft Arkansas is soft and coarse. The soft stones cut faster but produce a coarse edge. Certain species of fine sandstone, such as Queer Creek and Hindustan, possess this feature to a marked degree and are used extensively for sharpening scythes and other tools requiring a coarse edge.

The bench oilstone should be kept in a box such as shown in Fig. 2. If the stone has not been preoiled, it should be soaked overnight in a mixture of oil, 1 part, and kerosene, 1 part, Fig. 6. In use, the stone should be worn down uniformly to prevent the formation of a hollow. However, should the stone become hollowed, it should be rubbed flat on a piece of glass, Fig. 7, using

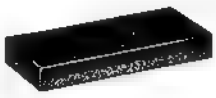
8 ARTIFICIAL STONES



SILICON CARBIDE
Hardest abrasive made. Cuts fast with light pressure, but breaks down under a heavy pressure

ALUMINUM OXIDE
Physically the same as natural corundum, hence often called "India." It is fast-cutting oilstone

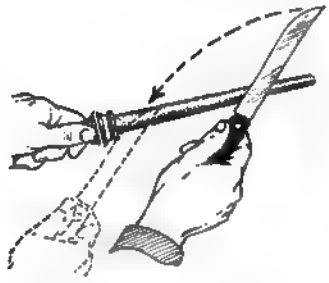
9 TYPES OF GRITS



COARSE-FINE
All oilstones can be obtained in a combination of two stones. Coarse-fine is most widely used

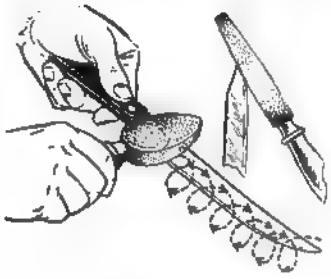
MEDIUM
The standard grits in artificial oilstones are: coarse, medium and fine. Combination type is best

Tips on Sharpening a Variety of Tools



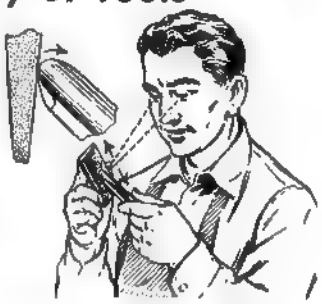
KNIFE (first method)

This type of sharpener is coarse-fine, cuts fast with little pressure and requires no oil. Start the initial stroke as shown, pulling the knife down smartly from heel to tip. Repeat on other side



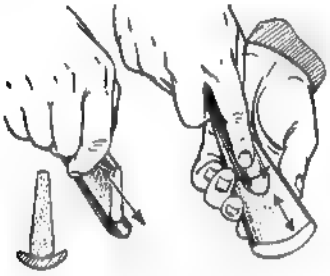
KNIFE (second method)

Stone is fine-grit silicon carbide, excellent for sharpening stainless steel. Honing is done dry or with water lubricant. Use little circular strokes, as indicated, working stone on one side, then on other



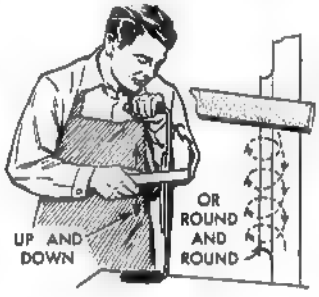
GOUGE

Use flat side of round-edge slip or surface of bench stone. Apply oil, then hold gouge steady and move stone up and down, at same time slowly rotating gouge. Clear view of bevel is had at all times



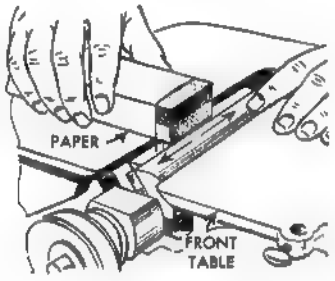
GOUGE (continued)

Wire edge from previous operation is removed by honing with round-edge. Use oil, hold stone flat on tool. Hollow stone is used to hone gouge having outside bevel to help keep proper bevel



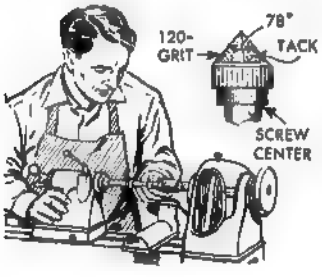
DRAWKNIFE

Use a scythestone or a flat stone of coarse grit. Stroke up or down or round and round. Watch bevel by sighting and use stone dry or wet. Same technique is used to sharpen blade of scythe or sickle



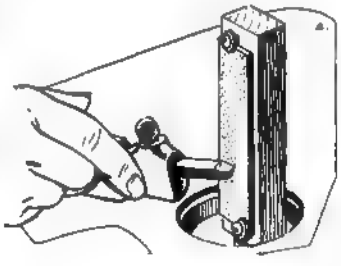
JOINTER

Hone jointer knives by wrapping bench stone in paper to prevent marking table. Wedge pulley to hold cutterhead steady. Use oil and hone lightly. Use coarse side of stone first if blades are dull



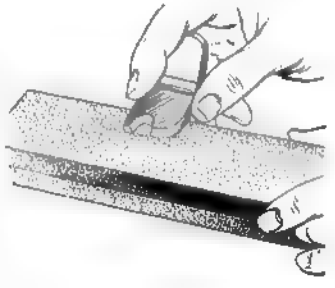
MORTISING CHISEL

If you are unable to obtain a stone of the correct cone shape for sharpening a mortising chisel, turn a wooden cone and cover it with silicon-carbide paper. Apply oil and run lathe at slow speed



LATHE TOOL BITS

Although having blunt edges, lathe bits will stand up much longer if honed to a medium or fine edge. If tool is carbide tipped, use silicon-carbide stone. Mount stone in chuck of jigsaw



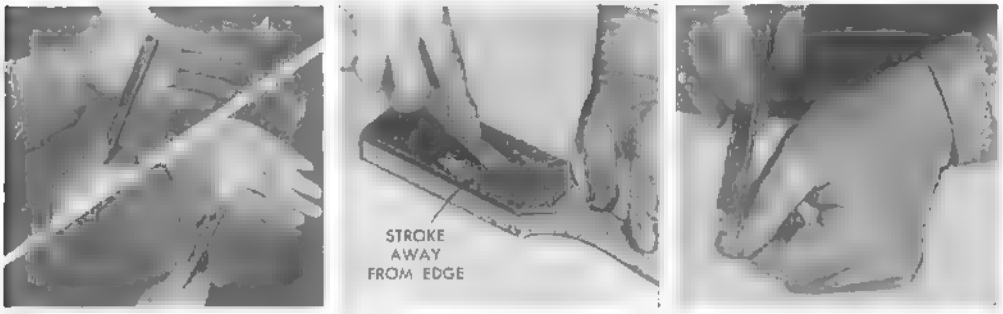
SHAPER CUTTERS

Use coarse, then fine side of bench stone. Hone only on flat side of cutter. Give bevel a light paring stroke with sharpening stick to remove wire edge. Molding cutters are honed the same

1. Chisel has been newly ground on 60-grit wheel, so honing starts on coarse side of stone. Apply a few drops of light oil beforehand

2. Hold chisel with heel slightly above stone, as shown in the side view. Stroke chisel back and forth using medium pressure

3. Alternate operations 2 and 3 until edge shows sharp with minimum of burr or wire edge. Repeat same steps on fine side of stone



4. To remove final burr or wire edge, hone the chisel on palm of hand, stroking away from edge. This bends and breaks wire edge

5. Velvety smoothness, provided previous steps have been done properly, is obtained by stropping chisel on smooth piece of leather

6. Test on your thumbnail — if chisel is sharp, it will bite in; if not, it will slide off. Make this test also at end of step 3

80-grit silicon-carbide grains and water as a lubricant. Silica sand also can be used to dress a hollowed stone.

Using the oilstone: There are no stroking rules in honing other than the obvious one of having the tool in contact with the stone at the proper angle. It is advisable, however, to hone against the edge of the tool whenever possible to hold burring to a minimum. Always use oil but avoid charging the stone with anything heavy or gummy. A kerosene-and-oil mixture is excellent. Being fairly thin, the mixture floats away any metal particles and prevents them from becoming embedded in the stone. It also permits smooth stroking and reduces friction. After a stone has been used, it should be wiped dry with a clean cloth. Never let oil containing metal particles dry on it, as this will form a glaze.

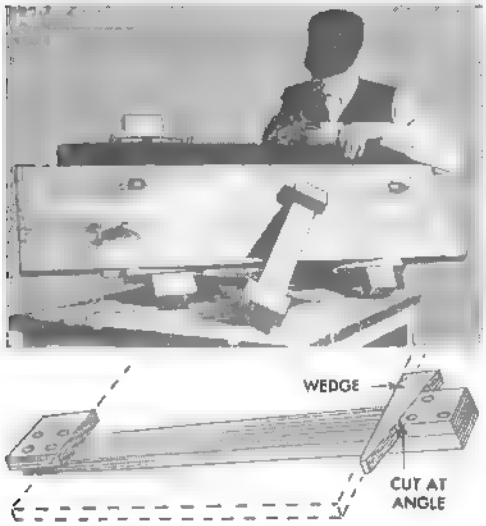
Kinds of edges: When magnified, any edge will show as a series of sharp "mountain peaks," and the relative size of the peaks classes the edge as coarse, medium or fine. When a chisel is ground on a 60-grit wheel, the edge may be sharp but it is very coarse. Honing on the coarse side of an oilstone gives an ordinary coarse edge, which then can be brought to any degree of fineness by honing on the fine side.

Honing suggestions: The photos in Fig. 10 show the general procedure in honing a chisel and the steps also apply equally as well to plane irons and similar tools. To construct a strop, Fig. 3, glue the leather to a wooden block with the hair side up. Hints on the opposite page cover honing operations for a variety of tools.

Household Lye Distinguishes Aluminum Stock From Similar Metals

When you wish to determine if a piece of metal actually is aluminum or another type of metal with a similar appearance, try this easy test. First make a 40-percent solution of household lye in water, being sure to use a glass container. Then, file or cut a few chips from the stock in question and drop them into the solution. If the chips produce a vigorous reaction and disappear in a few seconds, the metal is aluminum. When using this solution, be careful not to get it on your hands or clothing. Also, flush the drain thoroughly after disposing of the solution.

Wooden Bar Clamps Assembled From Scrap Pieces in Shop

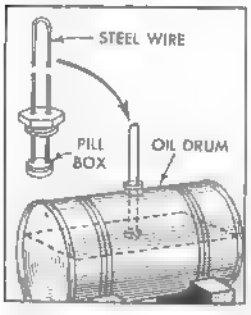


Next time you need a couple of clamps and metal ones are not readily available, a pair of wooden ones can be assembled quickly by screwing hardwood blocks onto 1-in. pieces near each end, as shown. Of course, the blocks should be spaced to accommodate the work at hand, after which suitable wedges are cut to apply pressure by driving them in place. Note that the inside edge of one corner block on each clamp is cut at an angle to correspond with the wedge intended for use in this position.

Stopping Water-Pump Squeak

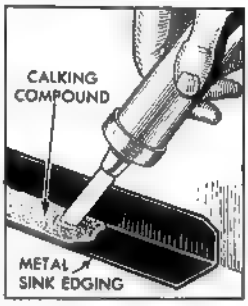
If the water pump on your car continues to squeak in spite of proper lubrication, try placing a tablespoon of liquid soap in the cooling system. This is not enough to cause foaming, but usually will prove effective in quieting the pump. If the noise continues, adjustment of the pump is indicated.

Simple Gauge for Fuel-Oil Drum Indicates Present Supply



A simple, homemade gauge makes it possible to keep a careful check on the contents of a fuel-oil drum at all times. The gauge is assembled by drilling two holes in the drum cap to take the ends of a U-shaped wire. These wire ends are then soldered to a small tin box, which must be sealed airtight by flowing solder along the edge of the lid. With the cap in place, the box floats on the surface of the oil, leaving the loop end of the wire exposed to indicate at a glance the fuel level in the drum.

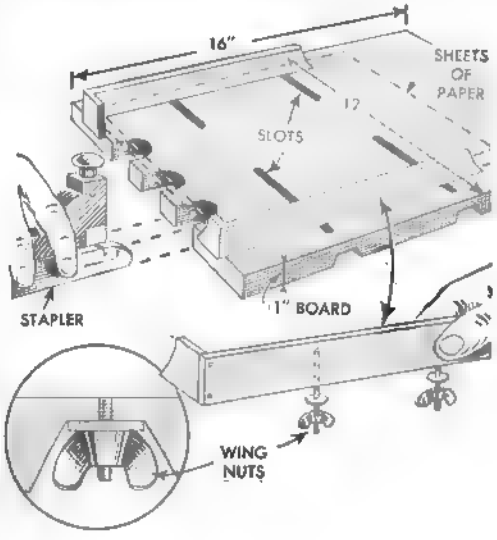
Calking Compound Seals Joint Between Sink and Edging



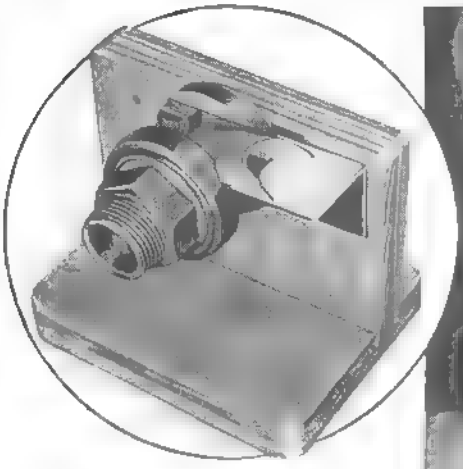
When applying either metal or plastic edging to built-in sink tops, one carpenter runs a line of calking compound into the corner of the edging as shown. When the edging is screwed in place, the compound spreads and effectively seals and waterproofs the joint between the linoleum and wood. In addition, the calked seam prevents water from running under the edging and down to the floor.

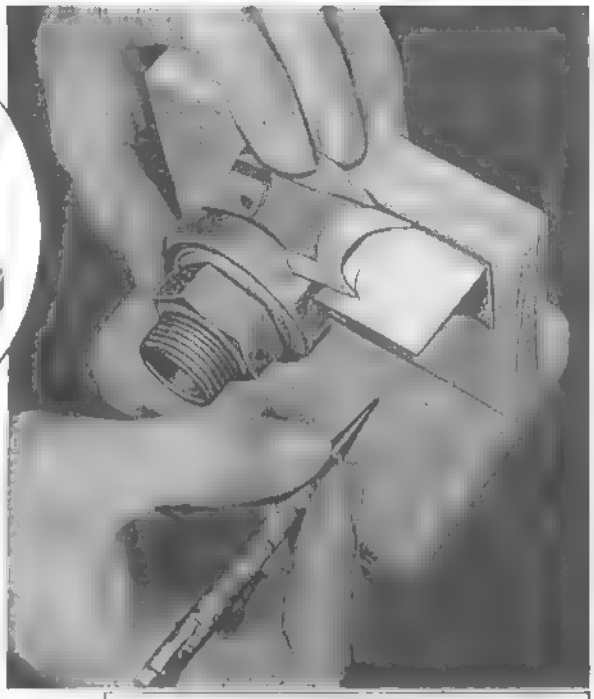
This Stapling Guide Saves Time

One office worker who often had to staple large numbers of papers together did the job uniformly and saved time and labor by using a guide board like the one shown. It is made from 1-in. stock and is fitted with adjustable guide strips for holding the papers stacked uniformly. Three notches at one end permit slipping the stapling machine over the edges of the papers at properly spaced intervals.



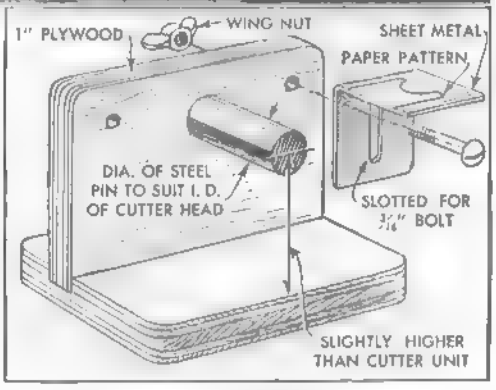
Fixture Aids Accurate Setting of Shaper Knives

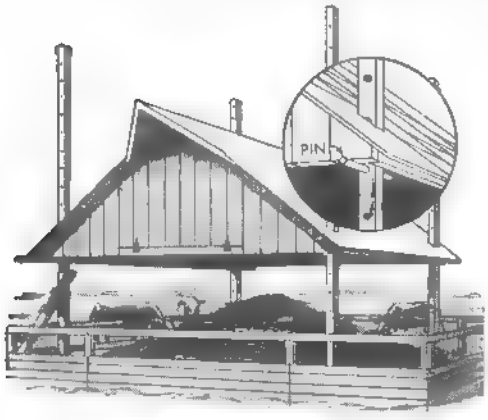




This handy fixture permits quick and accurate depth-setting of shaper knives held between collars, and also serves as a template for grinding identically the lips on common three-bladed cutters. As knife collars vary in design and size, exact dimensions for the fixture are not given. The base and upright are of plywood and a steel shaft to fit the cutter head is pressed into an undersize hole in the upright. An adjustable sheet-metal stop is fastened with a bolt and wing nut on either side of the shaft to accommodate both right and left-hand cutter heads. To use the fixture, a piece of paper is glued to the stop. The cutter head is placed on the shaft, held firmly against the upright and the outline of the cutting edge of one of the knives is traced on the paper. Then, the other knife is adjusted to the exact same depth by bringing the edge of it to the traced outline.

Richard Hanscom, Elmhurst, Ill.





Hay Barrack Has Adjustable Roof

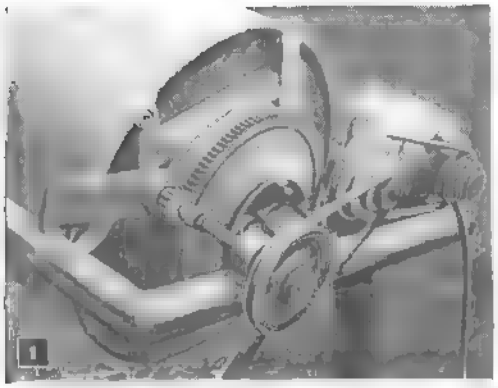
This unusual hay barrack with a roof that can be raised or lowered to various heights was built by one farmer in his cattle-feeding yard. The hay is pitched from the top of the stack to a manger fenced off around the bottom. As the height of the haystack decreases, the roof is lowered to provide the greatest possible amount of protection for the hay. The four long poles at the corners of the barrack are drilled at convenient intervals to take pins which support the roof at the desired height. A door and ■ short hay track are built into the gable. A block and tackle is used at each corner to raise the roof.

A. M. Wettach, Mt. Pleasant, Iowa.

POWER MIXER for FEED, SEED

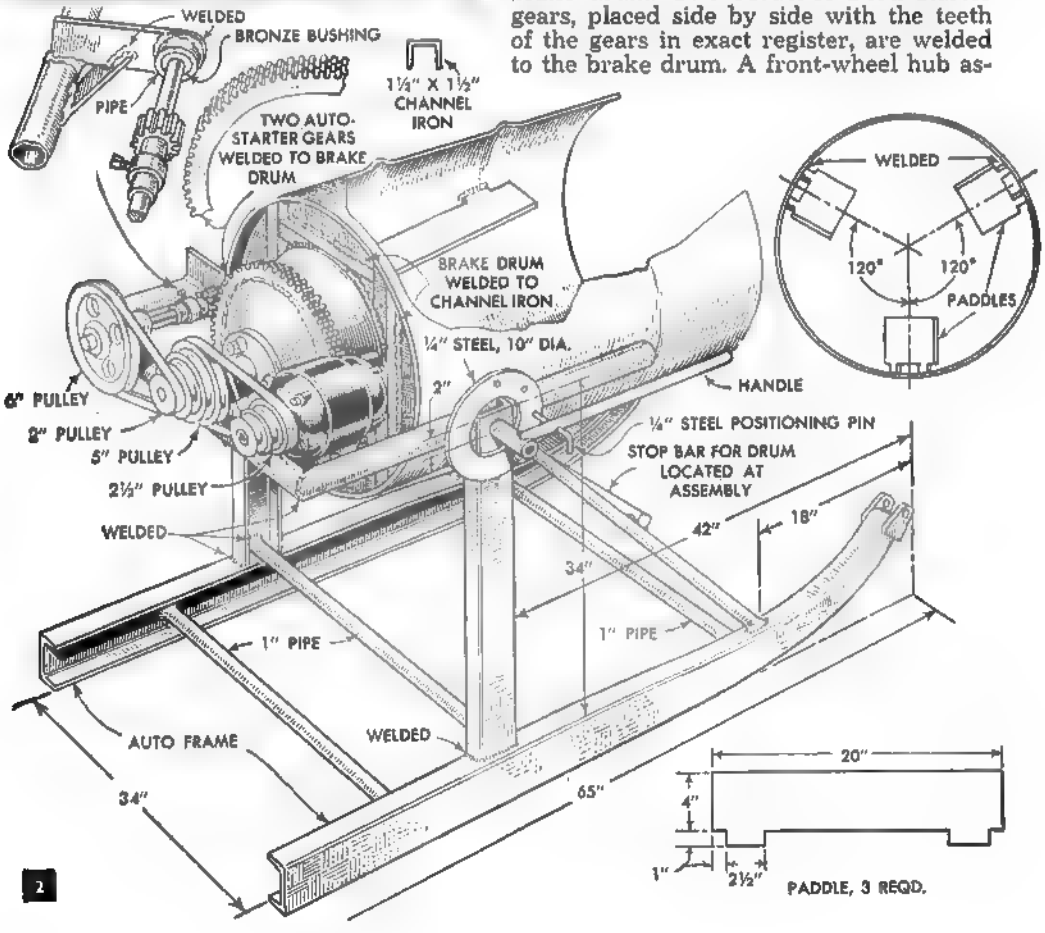
Used car parts and a 55-gal. oil drum are the principal units of this motor-driven mixer, which is used for mixing concrete, dry and moist feeds, and for dusting seed grains for fungus diseases

By Edward R. Lucas

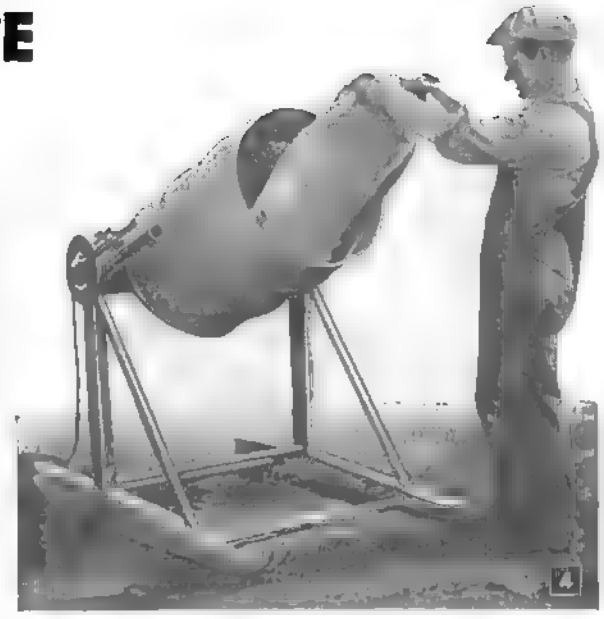


BUILT with metal runners cut from an old car frame, this electrically driven, self-contained mixer is easily moved to the work. It will handle almost any dry or moist material, such as finely ground feeds, cement aggregate and small grains which are to be dusted for fungus diseases. A triple-speed reduction through a two-stage V-belt drive, plus a pinion and gear, means that the machine requires only a ¼-hp. electric motor to handle the heaviest loads.

Fig. 1 pictures this multiple drive while Fig. 2 details the complete construction. A section of an old car frame and a number of chassis parts (rods, braces and the like) are welded together to make the frame for the machine. Next, pieces of channel iron are welded to the bottom of the oil drum to make a square base for a brake drum. Two Model-A Ford starter gears, placed side by side with the teeth of the gears in exact register, are welded to the brake drum. A front-wheel hub as-

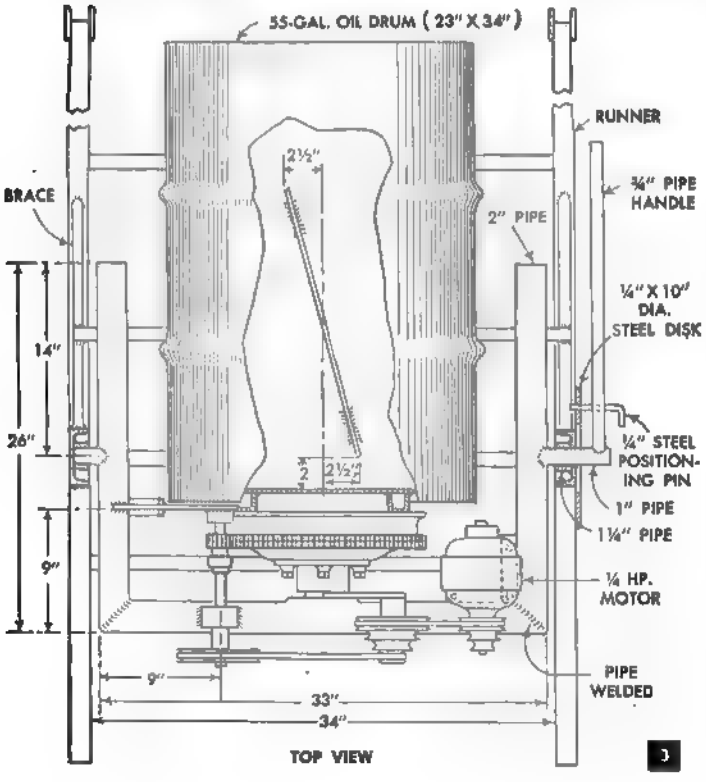


or CONCRETE



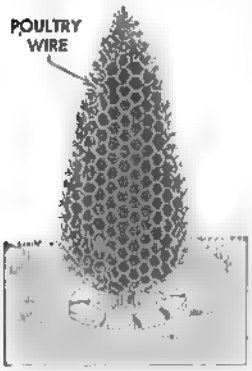
sembly is bolted to the brake drum, which then is tack-welded to the channel-iron base.

To make the U-shaped frame which supports the oil drum, cut three lengths of 2-in. pipe, mitering the ends and welding together as shown in Figs. 2 and 3. Next, short lengths of pipe are welded to opposite sides of the U-frame to serve as axles on which the oil drum pivots. Note that when the machine is assembled, as in Fig. 3, one axle extends through the channel-iron frame member so that a ¾-in.-pipe handle can be welded to it. A pin passing through a hole drilled in the handle enters holes drilled in a steel disk and holds the mixing drum in several positions from horizontal to vertical. Weld the end of the wheel spindle to the base member of the U-frame, so that the oil drum is centered in the frame. This arrangement allows the oil drum to turn freely on the roller-bearing wheel hub independent of other support.



Three paddles are welded inside the drum 120 deg. apart. These are of ¼-in. sheet steel cut to the dimensions given in the lower right-hand detail, Fig. 2, and are placed at the approximate angle indicated in Fig. 3. The upper left-hand detail in Fig. 2 shows the assembly of the pinion shaft. The pinion drive gear is fixed to the shaft by welding it to the end of a pipe nipple which in turn is locked on the shaft with a setscrew. The outer bushing or ball bearing is also in a housing which is welded to the U-frame, and a collar against this bearing holds the shaft in place. The ¼-hp. motor is bolted to an L-shaped base welded in one corner of the U-frame, as indicated by dotted lines in Fig. 3. A short length of pipe into which two bronze bushings are forced, provides a bearing for the jackshaft. The pipe is welded to a flat-iron arm, which is welded to the U-frame. Step V-pulleys on the motor and jackshaft permit a range of speeds. Finally, a stop bar for the oil drum is welded to the angle braces of the supporting frame. The bar should stop the drum at a point just slightly below the horizontal position.

Small Evergreens Protected With Poultry Wire



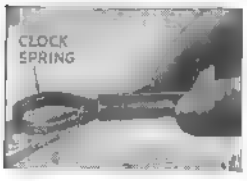
Shrubs and small evergreens will keep their shape and be protected from storm damage if they are wrapped with poultry wire. Use the large-size mesh so that the shrub will continue to grow unhampered.—Duke D'Ambra, Lawrence, Kans.

Raising Shallow Dents In Hard or Soft Wood

Hammer marks and other shallow dents in unfinished wood, such as furniture or woodwork can be raised flush with the surface by a simple heat treatment. Place a few drops of denatured alcohol in the dent, A, ignite, B, and let burn. The combination of heat and moisture will cause the wood fibers to swell and rise to the level of the surrounding surface. The spot then is sanded lightly, C, to remove any slight scorch that may result. This is effective only on very shallow dents and cannot be expected to raise deep depressions. Another method of raising a dent is to cover it with a dampened cloth pad and steam the wood by applying a hot soldering iron or household iron to the cloth. This treatment also will raise the grain of the surrounding wood and it will be necessary to sand down the raised grain. To remove a dent in ■ surface already finished, the varnish or paint, naturally, must be scraped from the dent and adjacent area.

R. E. Murray, Fremont, Ohio.

Handy Glue Spreader

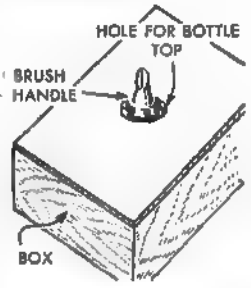


Desiring a fast way of spreading glue on narrow boards which I was laminating, I found that a piece of clock spring made an excellent tool for the purpose. The spring was formed into a loop and the ends inserted in the end of a dowel handle. In using the tool, I poured the glue inside the loop and then moved it slowly over the work, lifting the tool slightly to leave a film of glue. A hacksaw blade can be used in this same way, the serrated edge allowing the glue to level uniformly.

Kenneth Murray, Colon, Mich.

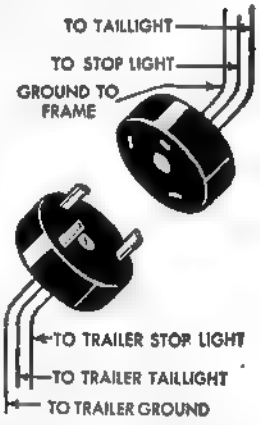
Bottle Holder Has Gluing Surface

In offices or homes where mucilage is used, ■ glue-bottle holder can be made from a cigar box or similar container. Bore a hole in the lid of the box to permit the bottle top and brush handle to project. Then place the glue bottle in the box and close the lid over it as shown. In addition to catching the drippings from the brush, the lid will serve as a place where gluing can be done without danger of smearing the desk or table top.—I. M. Fenn, Chicago.

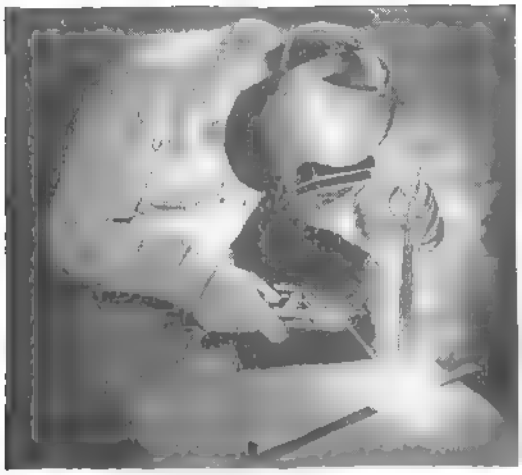


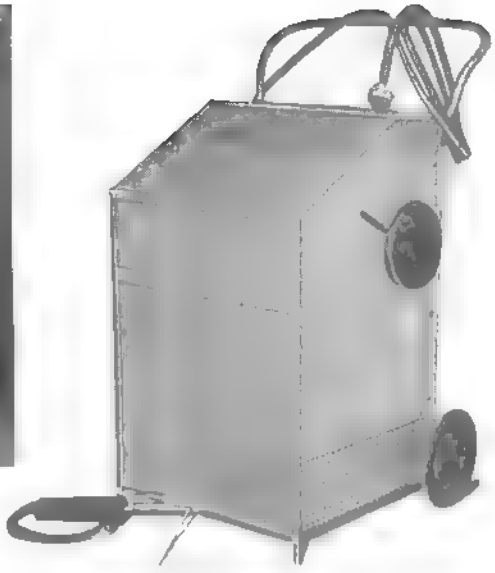
Electrical Coupling for Trailer Made From Sealed-Beam Sockets

To operate the taillight and stop light on his trailer simultaneously with those on his car, one motorist devised a convenient coupling from two sealed-beam headlight sockets. Three prongs are soldered into the slots of one of the sockets to make a plug, and its leads are spliced into the various parts of the trailer circuit as indicated. Then, the other socket is fastened under the rear of the car with two of its leads connected into the taillight and stop-light circuits and the third lead grounded to the frame. The wires of the plug should be long enough to enable it to reach the socket, and both plug and socket should be marked plainly so that the wires leading to corresponding parts of the trailer and car circuits will be connected.



C. Buxton, Chicago.





Build Your Own ARC WELDER

Part I

By Evan Wright

BY REWINDING a discarded or burned-out service transformer and installing it in a housing mounted on a two-wheel cart, this portable a.c. arc welder, shown in the upper right-hand photo, was built entirely with hand tools for less than $25. It will handle metallic-arc welding rods from the smallest up to 5/16 in. in dia. and can be regulated for use with a double-carbon arc torch for brazing, silver and soft soldering, and localized heating when bending, forging or heat-treating metal parts. In addition to welding, the metallic arc can be used for cutting metal and piercing holes when bolted construction is desired.

Selection of a transformer for rewinding is made on the basis of the output desired and the service current available. Where the welder transformer output required is approximately 150 amperes of welding current, the transformer should weigh at least 75 pounds exclusive of its cast-iron container or "pot." A welder of this output will handle almost any job on the farm or in the small shop and can be operated on a 220-volt circuit drawing a maximum of 30 amperes. Most shop or farm electric

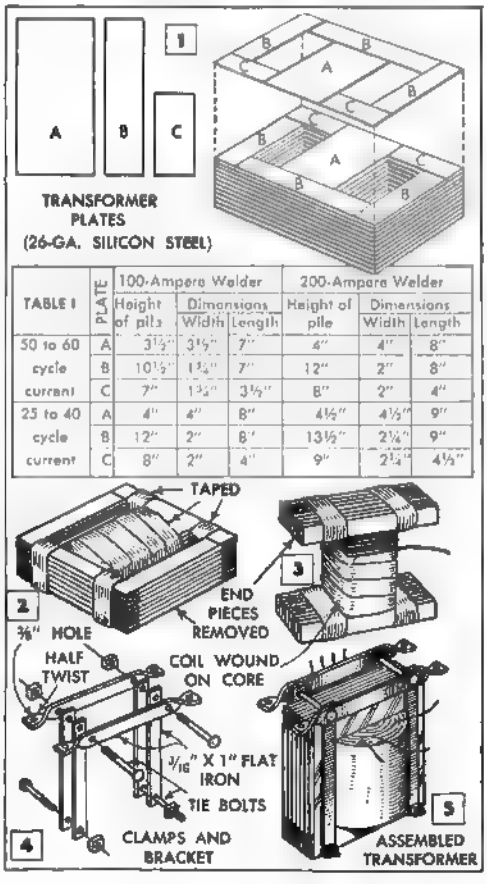
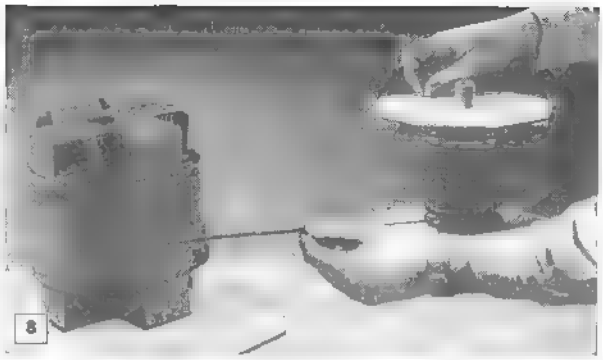
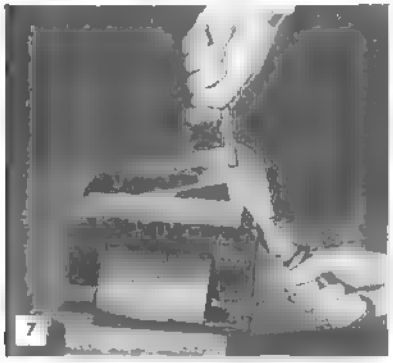


TABLE I	PLATE	100-Ampere Welder			200-Ampere Welder		
		Height of pile	Dimensions		Height of pile	Dimensions	
			Width	Length		Width	Length
50 to 60 cycle current	A	3½"	3½"	7"	4"	4"	8"
	B	10½"	1¾"	7"	12"	2"	8"
	C	7"	1¾"	3½"	8"	2"	4"
25 to 40 cycle current	A	4"	4"	8"	4½"	4½"	9"
	B	12"	2"	8"	13½"	2¼"	9"
	C	8"	2"	4"	9"	2¼"	4½"



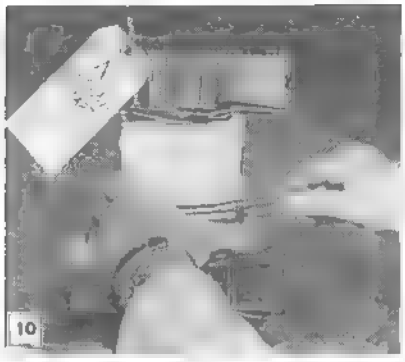


service will meet these requirements. However, check with your local electrician or power company as to the maximum load that may be imposed on the service line. Pole transformers, rated from 2 k.v.a. to 5 k.v.a., are recommended for making welders of approximately 150-ampere, 35 to 40-volt output. A smaller welder made from a rewound light industrial or X-ray transformer will deliver sufficient amperage for most welding jobs in the home shop and can be operated on 110 volts with less than 30 amperes. For light welders, the transformer alone should weigh at least 50 pounds. Pole transformers and X-ray transformers suitable for rewinding usually are of the shell type, and for compactness, a 3 or 4-part transformer is recommended. In buying a junked transformer, take only the transformer itself, as the pot which houses it is not needed. Usually, the transformer can be lifted from the pot by removing 4 or 6 bolts.

If a discarded service transformer cannot be found, you can build one from regular transformer iron of No. 26 to 29 gauge. Rectangular sections are cut to sizes indicated in Table I, Fig. 1, and these are stacked so that the pieces overlap one another in the manner shown. The core and the two sets of outer laminations are taped together tightly, Fig. 2, and then the end laminations are removed. The coils are wound directly on the core, Fig. 3, using the same size wires and procedure given for rewinding a junked transformer as will be described later. The end laminations are then replaced and clamps and brackets, Fig. 4, bolted to the core to compress and hold it together. Fig. 5 shows the completed transformer.

Dismantling a service transformer is done by first removing the porcelain cap used to distribute the leads. The clamps which hold the core sections also are removed, Fig. 6. These clamps usually are bolted to a cast-iron bracket from which the transformer hangs inside the pot. Coils in a common service transformer designed to reduce 2300 power-line voltage to 220 or 110 volts, usually have half the secondary winding wound directly on the core in two or more layers. These layers are covered with a fireproof insulating material over which the primary wiring is wound. The primary is covered with another insulating blanket and the remainder of the secondary is wound over this.

To proceed with the dismantling of the transformer, remove the 4 sets of outer laminations. These are cemented to each other with an insulating varnish and it may be necessary to use a linoleum knife and pliers to separate them as shown in Fig. 7. On some transformers the laminations are L-shaped, with the short legs alternating from one end to the other. Stack the laminations in a pile in the order in



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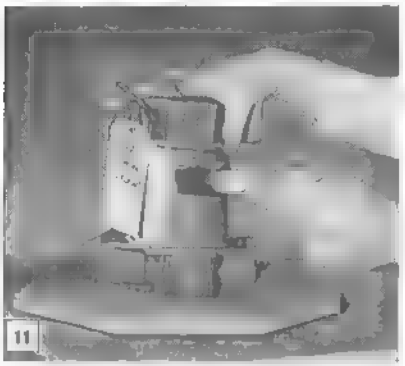

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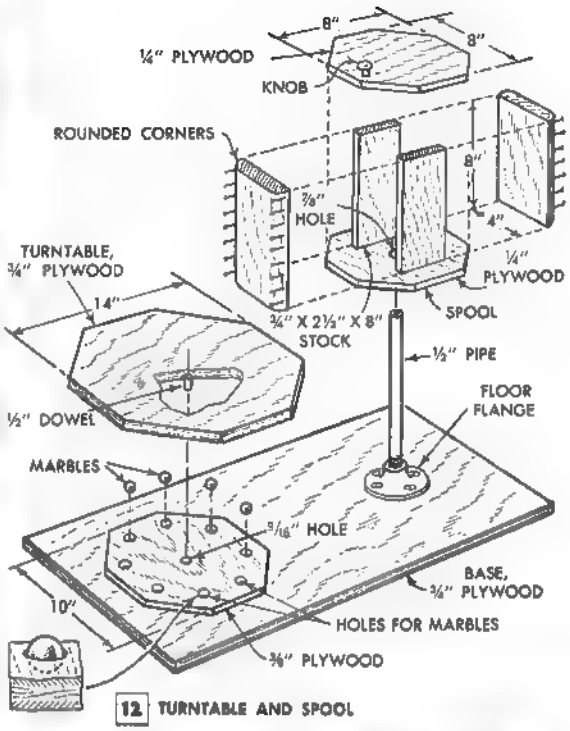


12 TURNTABLE AND SPOOL

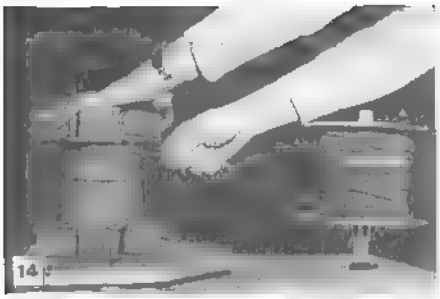
which they are removed and number them to correspond with the side of the transformer from which they are taken. Continue to remove the laminations from the other three sides, keeping each group stacked and numbered separately. After removal of the outer laminations, there remains the central core upon which the coils are wound. Using a turntable and spool, the construction of which is detailed in Fig. 12, remove the outer insulation from the first, or secondary, coil. Fasten the end of the wire to the spool and carefully unwind the coil as shown in Fig. 8. Being of smaller-gauge wire, the primary winding is wound on another spool in the same way. The inner coil, which will be of the same size wire as the first coil, should be wound on the first spool. Thick layers of glass or mica insulation separating the primary and secondary coils are removed, as shown in Fig. 9, and saved for reuse. The binding around the core should not be removed.

For arc welders delivering less than 100 amperes, the secondary coil should be wound with a wire size not less than No. 6 gauge and the primary with wire not less than No. 12 or 14 gauge. For the welder described, the secondary should be at least No. 3-gauge wire and the primary of No. 8 or 10 gauge. Original transformer wire can be reused if it is miked for size and then "paralleled" to make up the required gauge. Paralleling is done by combining a number of small-gauge wires and connecting them at the taps, thus providing a cross-sectional area equivalent to a larger-gauge wire. Table II, below Fig. 12, gives equivalent wire sizes to determine the number

TABLE II — WIRE EQUIVALENTS

WIRE GAUGE SIZE	NUMBER OF STRANDS AND WIRE SIZE NEEDED FOR SUBSTITUTE			
3	2 of #6	4 of #9	8 of #12	16 of #15
6	2 of #9	4 of #12	8 of #15	16 of #18
8	2 of #11	4 of #14	8 of #17	16 of #20
10	2 of #13	4 of #16	8 of #19	16 of #22
12	2 of #15	4 of #18	8 of #21	16 of #24
14	2 of #17	4 of #20	8 of #23	16 of #26

13



of any specific small wires necessary to make one wire of a desired size. Wires smaller than No. 16 gauge may be paralleled into a single strand by twisting them together with a hand drill. Larger sizes may be paralleled by laying them side by side on the coil.

The first portion of the secondary should be wound around the core by pulling out a lead about 6 inches long, and labeling it with a shipping tag, "A-start secondary." Then lay in the wire, using a single strand or several wires side by side as in Fig. 10. In most cases you should apply the first 15 turns in one layer. Wrap this portion of the secondary with two layers of cotton cloth and shellac it, Fig. 11. The cloth should be completely saturated. Next, wind another 15 turns over the first layer and tag the end of this coil, "B-1 secondary, 30 turns." Now, replace one of the insulating blankets over the secondary turns as in Fig. 13. Wind one layer of the primary over this blanket, first taking off a lead and labeling it, "primary start." Fig. 14 shows 5 strands of the original primary wire twisted together. Wrap this layer with one thickness of cotton cloth and shellac. Continue with the primary winding, insulating each successive layer with cloth and shellac. Take off taps at 110 turns, 165 turns and the final tap at 220 turns. Label these taps, "1 primary, 110 turns," "2 primary, 165 turns" and "3 primary, 220 turns." After this, replace the other insulating blanket and begin the second section of the secondary coil. Label the starting end of this secondary lead, "B-1 start, 3rd layer secondary," and after 15 turns, tap and label, "C-2, 3rd layer secondary, 15 turns." Insulate this with two layers of cloth and apply shellac. Continue on the fourth layer of the secondary, tapping after 5 turns and labeling the tap, "3 secondary, 5 turns." Make 5 more turns and tap, labeling, "4 secondary, 10 turns," then make 5 more turns or a total of 15 turns, and label the final tap, "5 secondary, 15 turns." After this, replace the laminations, driving the pieces into place with a softwood mallet as in Fig. 15. Finally, replace the yokes and brackets, using C-clamps, as in Fig. 16, to hold the laminations in compression until the holding devices are in place.

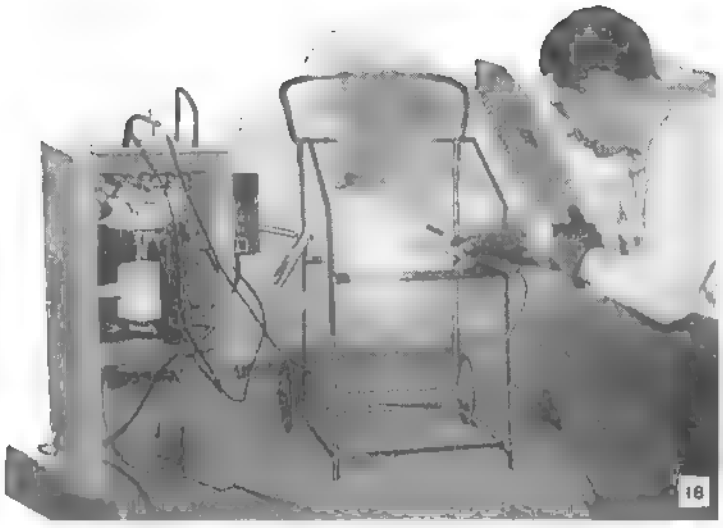
Long connecting wires are soldered to the leads, Fig. 17. Care must be taken to assure a permanent joint. Larger wires should be lapped and wrapped with fine wire before soldering. The secondary lead marked "B-1 secondary, 30 turns" may be connected with "B-1 start, 3rd layer secondary" and a common lead taken from them. The connecting leads should be about 2 feet long and fitted with lugs soldered in place. These leads may be insulated by wrapping and shellacking or by slipping sections of loom over them. If it is necessary to remove the identification tags when making the soldered joints, they should be immediately replaced to avoid any confusion later.

Build your own

ARC WELDER

Part II

By
Evan Wright

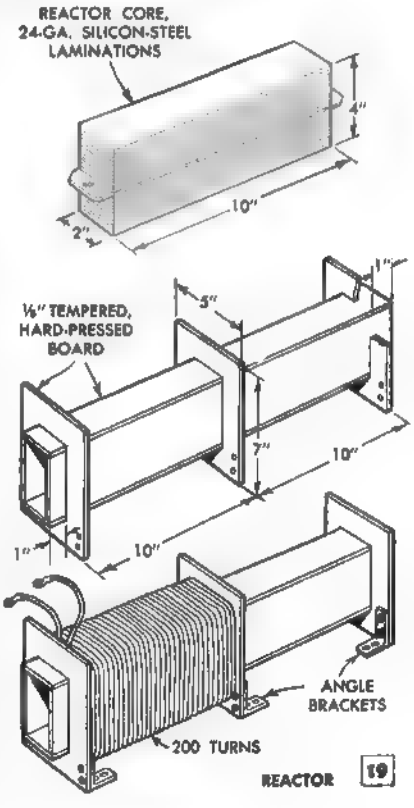


The welder parts are wired temporarily and used to weld the cabinet frame

NO ATTEMPT has been made to rewind the transformer, described in Part I, with enough primary resistance to prevent blowing the line fuses when an excessive load is thrown on the secondary. In fact, it is best to have the primary resistance comparatively low to permit a current-controlling device known as a reactor to be introduced in the primary circuit, as shown in the wiring diagram, Fig. 20. Selection of the various welding currents or "heats" is controlled by inserting plugs, connected to a primary loop and two welding cables, into jacks connected to the transformer leads. A jack board, Fig. 21, supports the jacks which are labeled for ease in selecting the different secondary and primary combinations. Further adjustment of the current is made by regulating the reactor.

To make the reactor, cut enough laminations to make a core the size indicated in the upper detail of Fig. 19. Note that the center lamination is slightly longer than the others, and has holes drilled in each end. The laminations are held together by wrapping tightly with tape. A square tube having inside dimensions just large enough to permit easy insertion of the core is glued together as detailed in Fig. 19. One half of the tube is wrapped with 200 turns of wire of the same size used in the transformer primary coil. Each layer of wire should be insulated with cotton cloth and shellac.

To make the jack board, cut out and drill 3 pieces of hard-pressed board to the dimensions given for the cover plate, Fig. 21. The holes should make a snug fit with the 3-in. lengths of



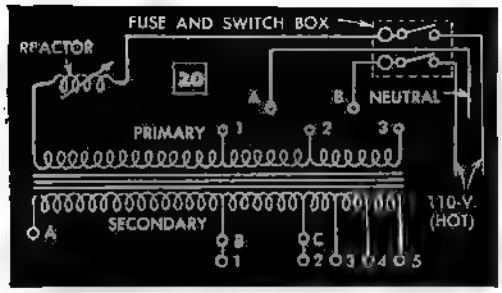
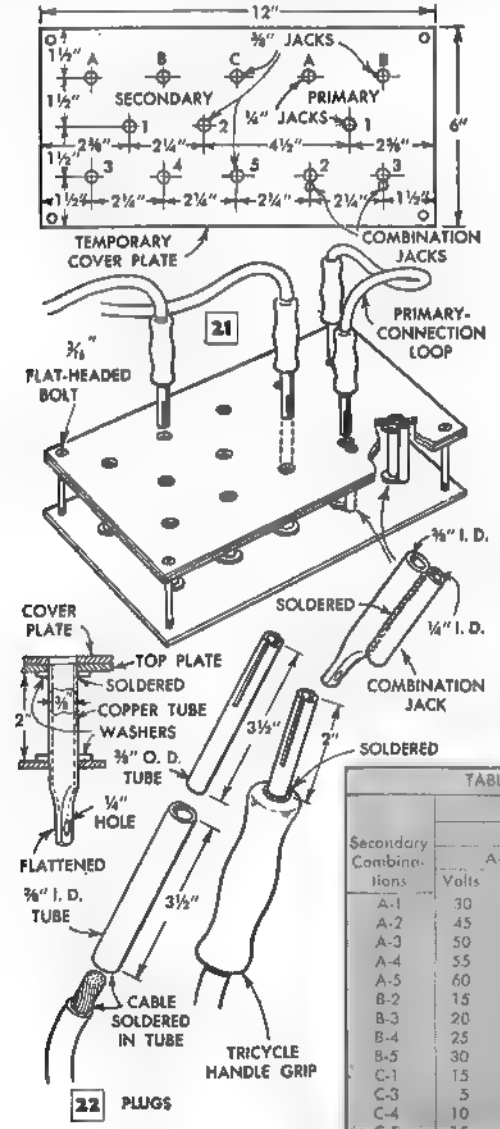


TABLE III — SECONDARY CONNECTIONS					
A-1	30 turns	B-1	dead	C-1	15 turns
A-2	45 turns	B-2	15 turns	C-2	dead
A-3	50 turns	B-3	20 turns	C-3	5 turns
A-4	55 turns	B-4	25 turns	C-4	10 turns
A-5	60 turns	B-5	30 turns	C-5	15 turns



copper tubing used for the jacks. Note that jacks A and 1 for the primary are made of ¼-in. i.d. tubing and that combination jacks 2 and 3 of the primary consist of ¼ and ⅜-in. tubes soldered together so that either of the two loops, described later, can be used. All others are of ⅜-in. i.d. tubing. The jacks are sandwiched between the pieces of board which are spaced by washers soldered to the jacks as indicated in the sectional drawing, Fig. 21. The whole unit is held together by bolts at each corner of the boards. The ends of the jacks that project through the bottom of the jack board are flattened and drilled for connection with the transformer leads.

The primary-connection loop, Fig. 21, is next. Although only one loop is used at a time, two are required, one with ¼-in. plugs, the other with ⅜-in. plugs. These two loops of different sizes are necessary to prevent a connection across B and 1 on the primary, which would give high-voltage currents on the secondary that would be dangerous to handle and unsuitable for arc welding. The plugs, Fig. 22, are made from lengths of ¼ and ⅜-in. copper tubing each of which is split lengthwise with a saw for a distance of 1½ in. from one end to produce a tight fit when inserted into the bore of the jack tubes. The other end is soldered into a 3½-in. length of ¼ or ⅜-in. i.d. copper tubing so split end projects 2 in. A 12-in. length of No. 8 gauge flexible wire is soldered to the ends of the larger tubes. The plugs are then insulated with tricycle handle grips, leaving the split tubing exposed for a distance of 2 in. Plugs for the ground and electrode-holder cables are made in the same manner. These cables are of No. 2 gauge rubber-covered flexible wire each about 20 ft. long. In use, these cables are plugged into the secondary circuit.

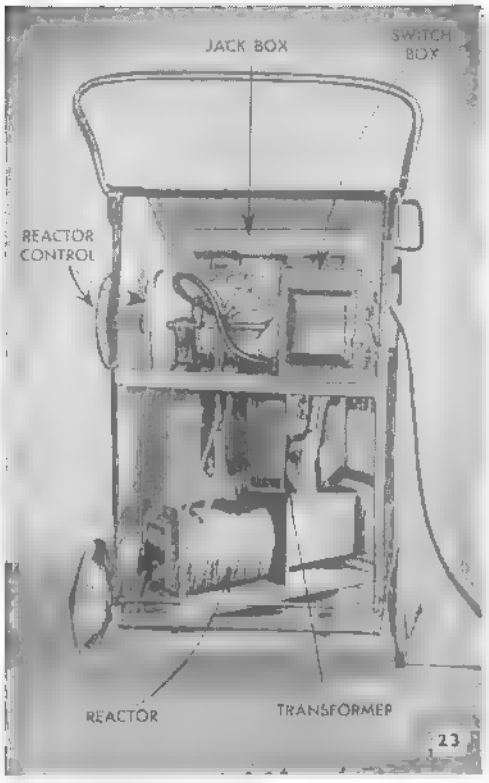
The transformer and other electrical parts now can be mounted in a temporary wooden frame as shown in Fig. 18, and used to weld the frame for the welder

TABLE IV — NO-LOAD VOLTAGES AND MAXIMUM AMPERAGES

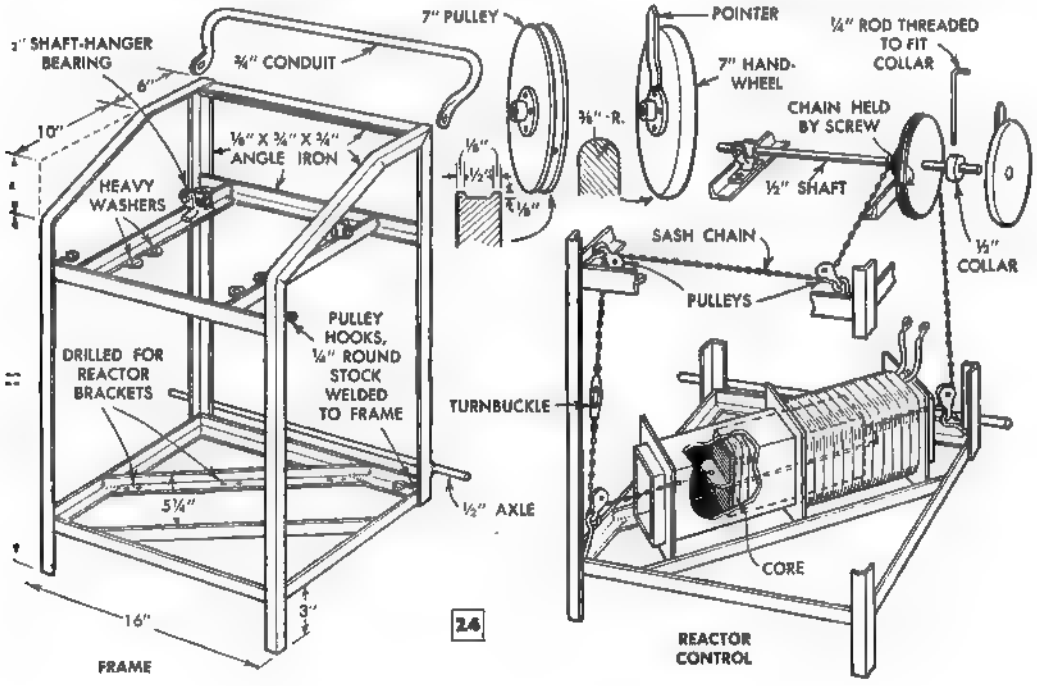
Secondary Combinations	Primary Combinations									
	110 Volts						220 Volts			
	A-1		A-2		A-3		B-2		B-3	
	Volts	Amps.	Volts	Amps.	Volts	Amps.	Volts	Amps.	Volts	Amps.
A-1	30	110	20	165	15	220	40	165	30	220
A-2	45	73	30	110	23	143	60	110	45	148
A-3	50	66	33	100	25	132	67	98	50	132
A-4	55	60	37	89	28	118	73	90	55	120
A-5	60	55	40	82	30	110	80	83	60	110
B-2	15	220	10	330	8	415	20	330	15	440
B-3	20	165	13	252	10	330	27	244	20	330
B-4	25	132	17	195	13	252	33	200	25	264
B-5	30	110	20	165	15	220	40	165	30	220
C-1	15	220	10	330	8	415	20	330	15	440
C-3	5	660	3	1100	3	1100	7	940	5	1320
C-4	10	330	7	470	5	660	13	508	10	660
C-5	15	220	10	330	8	415	20	330	15	440

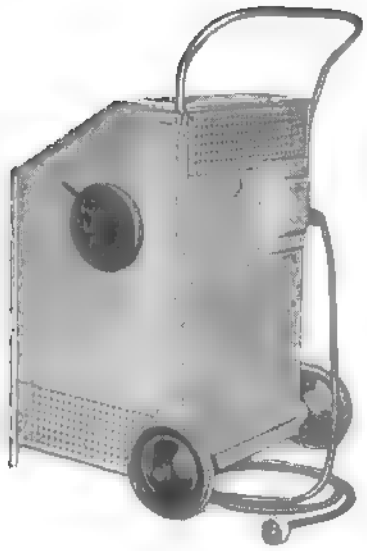
cabinet, Fig. 24. The wiring diagram, Fig. 20, indicates how the connections are made to a split 220-volt power line. Use a d.p.s.t. switch and box with two 30-ampere fuses. The transformer leads are connected to the jacks, which are labeled to correspond with the tags on the leads. By making a connection across primary jacks A and 1 with the connection loop, 110 volts are impressed on the 110 turns. The combinations of jacks A-2 and A-3 give 110 volts through 165 and 220 turns respectively. When connections across B-2 and B-3 are used, the voltage is 220 through 165 and 220 turns. Table III gives the number of turns for the various secondary combinations. Table IV gives the approximate no-load voltages with the different combinations of primary and secondary hookups. These voltages can be varied by adjustments of the reactor.

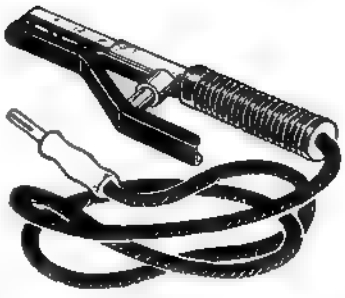
Before starting to weld, several accessories must be purchased. An electrode holder as shown in Fig. 25 is connected to one of the 20-ft. cables and a lug or clamp is connected to the other to serve as a ground cable. A helmet of the type shown in Fig. 25 or a hand-held face shield, shown in Fig. 18, must be used to protect the eyes and face from the rays of the welding arc. Do not attempt to arc weld with dark-colored goggles such as used for oxyacetylene welding. To protect the hands, leather welders' gloves should be used. In addition you will need 5 lbs. each of 1/16, 3/32 and



The electrical parts are mounted in a frame having two wheels for ease in moving around the workshop

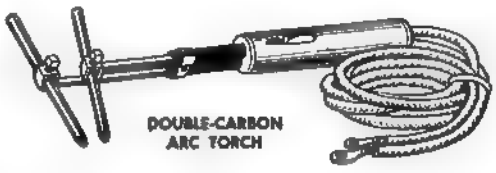






ELECTRODE HOLDER

HELMET



DOUBLE-CARBON ARC TORCH

23

⅛-in. mild-steel electrodes or welding rods. These must be the coated type for use with an a.c. welding machine, because the d.c. type will not work properly.

If you are inexperienced in arc welding, make some practice welds on scrap iron to get the feel of handling the arc before welding the frame. To start welding, clamp the ground-cable lug to the work and then connect the cable to jack B on the secondary. Connect the electrode-holder cable to jack 5 on the secondary. Then connect the primary across ■ and 2 with the connecting loop. Adjustment of the reactor, which may be laid on the floor, is made by sliding the core in the tube and locking it in place with small wooden wedges. Start with the reactor wide open and cut down the current by moving the core into the coil until you get the desired current. You may have to use ■ different combination on the jack board. Arc welding requires from 30 to 40 volts to maintain an arc manually. The amperage may vary considerably depending on the size of the electrode used.

With ■ ⅛-in. electrode in the holder and your eyes protected with the helmet, scratch the tip of the electrode across the scrap iron as you would a match, and then quickly lift it about ⅛ in. to form an arc between the tip and the iron. When a puddle of molten metal forms on the iron, slowly move the rod toward the right. Simultaneously with this movement feed the rod downward as it melts off, thus maintaining a uniform arc length. The melting rod will deposit a bead of weld metal on the scrap iron. To break the arc, merely pull the rod away from the weld. After the weld cools, remove the coating of slag, which covers the surface of the weld, with a cold chisel and wire brush. The surface of a good weld will have uniform ripples in it. If the tip of the rod sticks or "freezes" to the work, move the rod from side to side vigorously while pulling upward. If this does not free the rod it must be immediately released at the jaws of the holder to avoid overheating and injury to the rod coating. Difficulty in starting and maintaining an arc usually can be overcome by increasing the welding current slightly. Practice welding straight, flat beads with various sizes of electrodes, and experiment with the adjustments on the welder until the best current settings have been found. Then butt two pieces of scrap iron together, leaving a gap of 1/16 in. Make a small weld at each end of the scrap-iron pieces to hold them together, and run a continuous weld along the joint. After cooling, break the pieces apart through the center of the weld and examine it for depth of weld penetration. Insufficient penetration is caused by using too low a welding current or too fast a rate of travel. Fillet welds, which are used to join two pieces of metal at right angles, also should be practiced. When welding joints of this type, hold the rod at an angle which bisects the angle between the two plates. If difficulty is encountered in producing a weld that is fused into both pieces uniformly, the work may be tilted at a 45-deg. angle and the rod held vertically.

After satisfying yourself of your ability to make a good weld, start making a cabinet frame, Fig. 24, which supports all the various parts shown in Fig. 23. All the

angle-iron parts for the frame should first be cut, fitted and tack-welded together. Then, after checking for trueness, make continuous welds at all the joints. The entire assembly is mounted on wheels. Dimensions for locating the angle-iron supports for the transformer are not given as they must be determined from the size and type used. Four large washers, welded to the supports to correspond with the bolt holes in the mounting brackets of the transformer, hold it firmly in place. The reactor is set on angle irons welded diagonally across the bottom of the frame and is controlled by a handwheel, as shown in Fig. 24. By turning the handwheel, the position of the core in the tube is adjusted. However, as a strong pull is exerted on the core when the reactor coil is energized, the core must be locked in place after it is adjusted. This is accomplished by turning the ¼-in. rod, Fig. 24, which is threaded to fit a tapped hole in a ½-in. collar on the handwheel shaft. The rod, which extends through the top panel of the cabinet, acts as a setscrew and thus prevents the shaft from turning. The jack board is supported by a panel of hard-pressed board covering the slanted portion at the top of the frame. This panel becomes the permanent jack-board cover. The temporary jack-board cover may be used as a template to drill the holes accurately. The switch box is welded to the rear of the frame and the electrical parts are wired as in Fig. 20. A length of 3-wire (No. 10 gauge) flexible cable and a 3-way plug and receptacle are used for connection between the switch box and power line. The sides of the frame are covered with panels of hard-pressed board and perforated metal, as shown in Fig. 25. All panels are bolted to the inside surface of the angle-iron framework. After painting the entire cabinet, label the jacks and number five equally spaced positions of the reactor handwheel to indicate the position of the core in the reactor coil. A record of best operating current adjustments for various rod sizes should be kept for reference.

The double-carbon arc torch, Fig. 25, is a useful accessory for this welder as it supplies a self-contained arc flame for welding and heating metals.

Water Helps to Remove Tires

Sometimes an auto tire which has "frozen" to the wheel rim is almost impossible to pry or jar loose. However, if water is poured into the groove formed by the rim and the tire bead and allowed to stand for a few minutes, the tire will loosen with comparatively little effort.

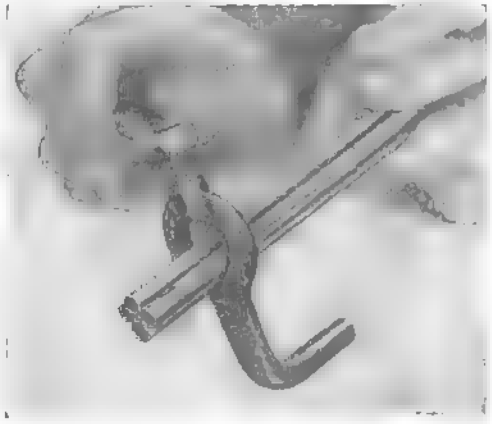
Charles R. Best, Lethbridge, Alta., Can.

Photograph of Window Display Aids Customer's Selection

As his window display contained many items that the customers often could not name specifically, one enterprising merchant kept a large photo of his window display handy at the store counter. This saved time for both the customer and himself by enabling the customer to point out the desired item without leaving the counter.

Lathe Dog Holds Rods for Cutting

Several lengths of small rod or tubing may be cut off accurately at one time if they are clamped in a lathe dog. As these dogs come in different sizes, use one in which the material can be clamped as shown. After the work is clamped, the dog is held in a bench vise for cutting. To prevent damaging thin-wall tubing, a small V-block should be used between the clamping bolt and the tubing.



Practical Steel Foot Scraper Utilizes Old Wagon Wheel

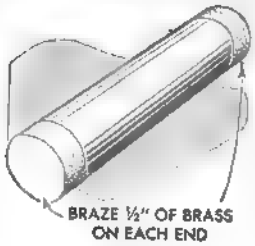
There's good use to be had from that old steel wagon wheel rusting away behind the barn. Place it near the porch steps or by the rear entrance, give it a coat of paint and you'll have an excellent foot scraper. A stake through the hub will anchor it.

Dealer Furnishes Bulletin Board As Service to Customers

As an added service to his customers, one feed-and-seed dealer mounted a bulletin board in his store to be used by people in the community to post "For Sale" or "Wanted" items. The service is free and has a double purpose in that it brings people into the store and builds up good will among potential customers. Users of the board take care of removal of the signs when they are no longer needed.

LeRoy Lincoln, Minneapolis, Minn.

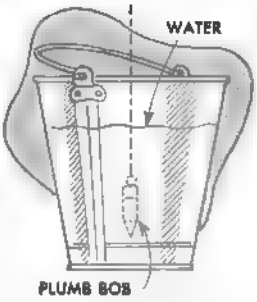
Soft-Nosed Punch Improvised From Auto Kingpin



Needing a soft-nosed punch or drift to drive a threaded axle, I made one from an auto kingpin. Being made from hardened steel, the kingpin will withstand hammering, and by building up a ½-in. thickness of brass brazing rod on each end of the pin, I obtained a soft head that would not damage the work. Where a punch of greater length is needed, two or more kingpins can be brazed end-to-end, after first chamfering the abutting ends.

John A. Stankiewicz, Louisville, Ky.

Pail of Water Steadies Plumb Bob When Working in High Wind

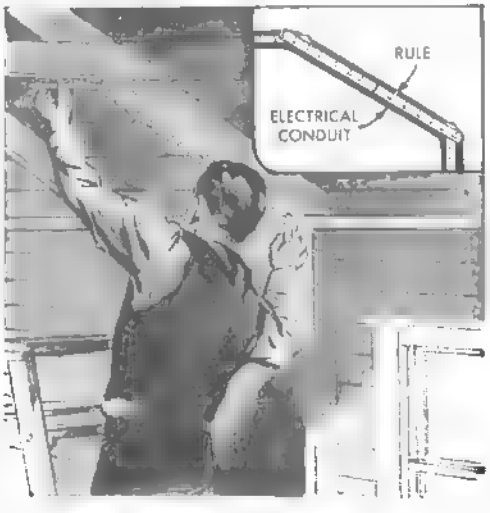


If you are working in a high wind, a plumb bob and line will remain fairly steady when the bob is immersed in a pail of water. If a pail is not available, shelter the plumb bob and string from the direct action of the wind by standing a wide board on the windward side or by blocking the wind with your body.

Charles Lothardt, Baltimore, Md.

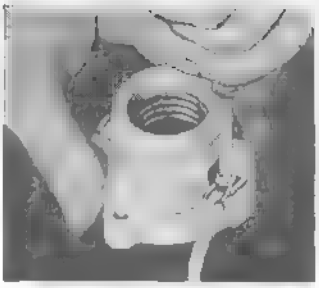
Zigzag Rule Is Substitute For Contour Gauge

When wiring my garage recently, I found that a carpenter's folding rule of the zigzag type was just the thing to determine the shape to bend the conduit. After adjusting the folding sections of the rule to conform to the wall, I used it as a contour gauge and bent the conduit accordingly. The same idea can be used to determine the amount of offset in a water pipe.—E. W. Moses, Jr., Blacksburg, Va.

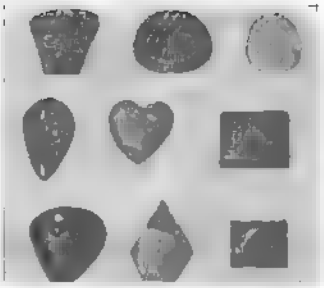


CRAFT QUIZ

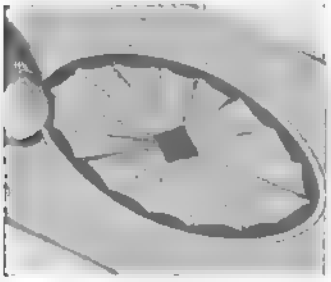
1. Plane he is using is—
(a) Jack (c) Jointer
(b) Block (d) Smoothing



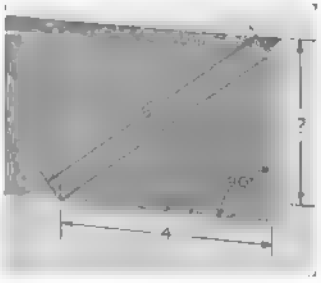
2. What is wrong here?
(a) Kind of socket (c) Wire loop
(b) Kind of wire (d) Screwdriver



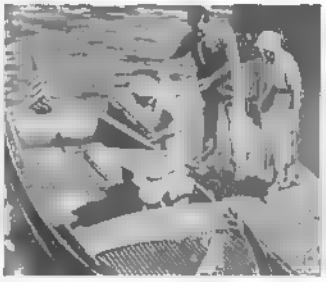
3. These gem stones are cut—
(a) Brilliant (c) Rose
(b) Cabochon (d) Step



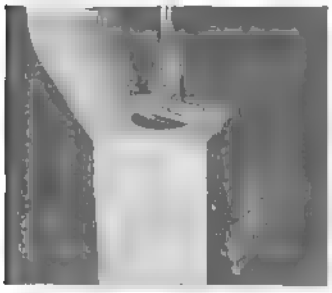
4. This inlay is a—
(a) Sunburst (c) Anthemion
(b) Cornflower (d) Urn



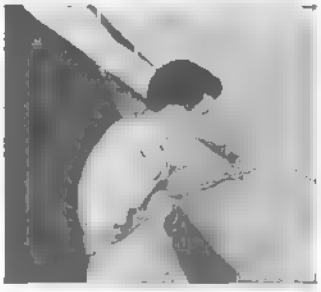
5. This board is—
(a) 3" wide (c) 2⅞" wide
(b) 3⅛" wide (d) 1" thick



6. Best wood for boat is—
(a) Pine (c) American mahogany
(b) Oak (d) Philippine mahogany

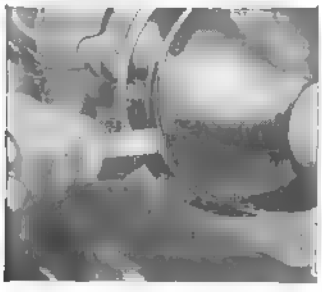


7. Boring is done with—
(a) Boring bit (c) Forstner bit
(b) Expansive bit (d) Gimlet bit

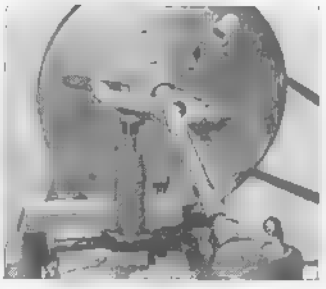


8. This boat plank is called—
(a) Garboard (c) Gunwale
(b) Sheer strake (d) Shutter

9. Getting set to do—
(a) Dovetailing (c) Box joint
(b) Mortising (d) Cogged joint

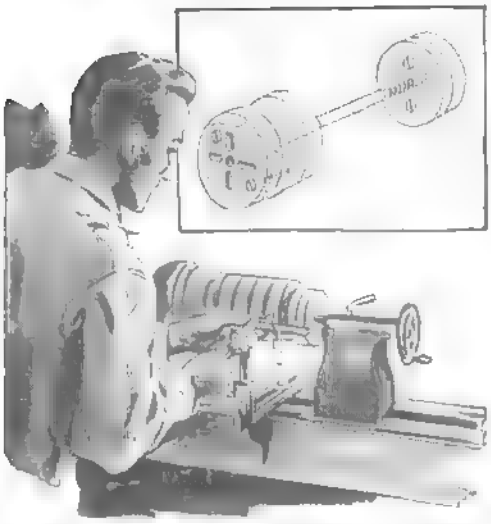


10. This metal-spinning tool is—
(a) Bead (c) Diamond
(b) Flat (d) Point



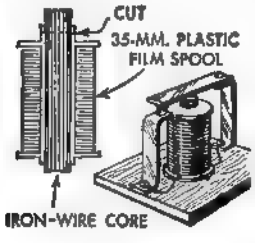
11. Work-holding device is a—
(a) Cat (c) Clamp
(b) Dog (d) Tail

Mandrel Permits Multiple Turning Of Wooden Toy Wheels



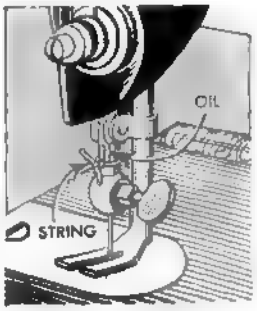
When duplicate wooden wheels are needed, such as those for toys, they can be turned four or more at a time by mounting them on this improvised lathe mandrel. The mandrel consists of four disks, three being of wood and the other of metal, and a machine bolt. The bolt should be the same size as the axle of the toy and of a length that will make the distance between the jaws of the mandrel slightly greater than the combined thickness of the four pieces of work. The head of the bolt is held between two wooden disks, one of which is drilled through the center and countersunk for the bolt head, and the other screwed to it as shown. The metal disk, ⅛ in. thick, is drilled and tapped for the threaded end of the bolt and, in turn, is screwed to a wooden disk. Drill a hole halfway through the wooden disk for the end of the bolt. Finally, mount the mandrel between centers and true up the jaws. In use, the work is drilled to fit the bolt, then roughly cut to size and mounted and tightened on the bolt by turning up the jaw on the end of the bolt. The whole assembly is replaced in the lathe, using the original spur and tail center marks.

Coils Wound on Film Spools



If you wish to make a small electromagnet for a relay, the plastic spool from a 35-mm.-film cartridge provides an excellent form. Drill out the thin web in the end of the spool, insert short lengths of soft-iron wire for the core, and cut off the top end as shown. Then, drill a hole in a wooden base to hold the electromagnet in place. These plastic spools also are suitable forms for winding radio coils and resistors.—Henry Zave, Chicago.

Cotton String Absorbs Excess Oil From Sewing-Machine Head

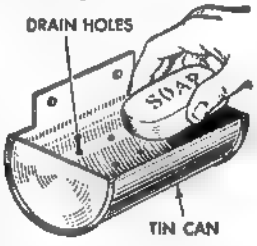


To prevent oil from spotting material after a sewing-machine head has been lubricated, tie a short length of cotton string tightly above the needle bar, as shown in the drawing. The string will absorb the excess oil and prevent it from seeping down to the cloth. Check the string occasionally and, when it appears to be saturated with oil, replace it.

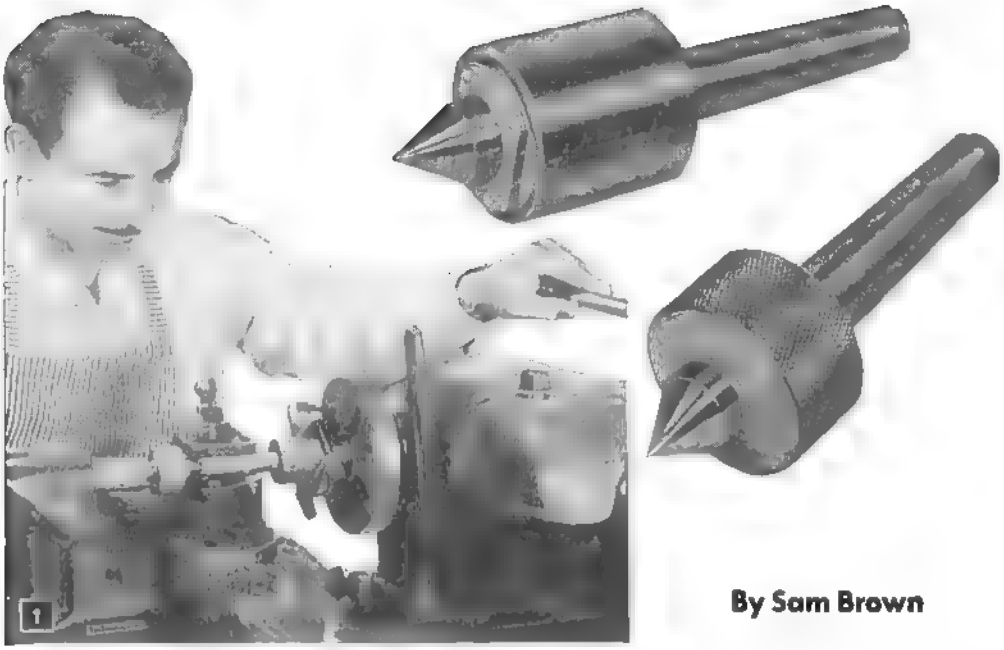
Uses for Toothbrush Containers

Instead of discarding plastic toothbrush containers, put them to use either as decoration or for utility. For example, if decorated with decals and fastened to the molding or walls with cellulose tape, they make attractive bud vases. In the nursery they are useful containers for swabs. They also serve as a protective cover for scissors, and in the kitchen they can be used to protect the blades of sharp knives.—Edward B. Tunstead, Minneapolis, Minn.

Tin Can Serves as Soap Dish



For use in the shop or basement where appearance is not too important, a handy soap dish is made from an ordinary tin can. Obtain a fruit-juice can from which the top has not been removed, and cut it in half lengthwise, leaving a tab on one side as shown. Dull the sharp edges of the metal with a file, and then drill or punch several drain holes in the can and holes in the tab to fasten it to the wall. If you prefer, leave off the tab and punch holes through the ends of the can to suspend it with wire between two faucets.—A. E. Fenn, Chicago.

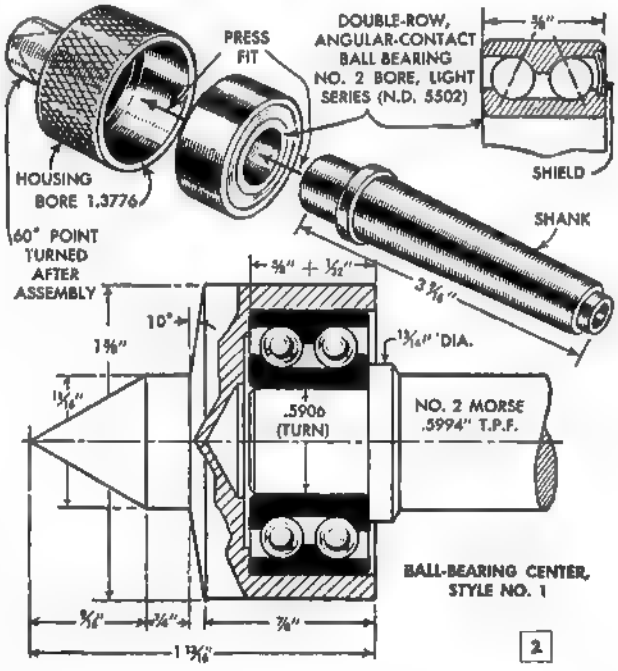


By Sam Brown

BALL-BEARING CENTERS

BECAUSE a ball-bearing center decreases the work load and eliminates oiling, it is a practical lathe accessory. The two types described here will handle any ordinary job that requires a tail center. Bearings must be the angular-contact type specified, as the finished center cannot be made rigid enough to withstand extremely heavy cuts when an ordinary, radial-type bearing is used.

Fig. 2 shows construction of style No. 1. The center point and housing are turned in one piece from a length of 1¾-in. cold-rolled steel. First turn the housing to the outside diameter and then knurl. With the same chucking, bore the inside of the housing, Fig. 3.

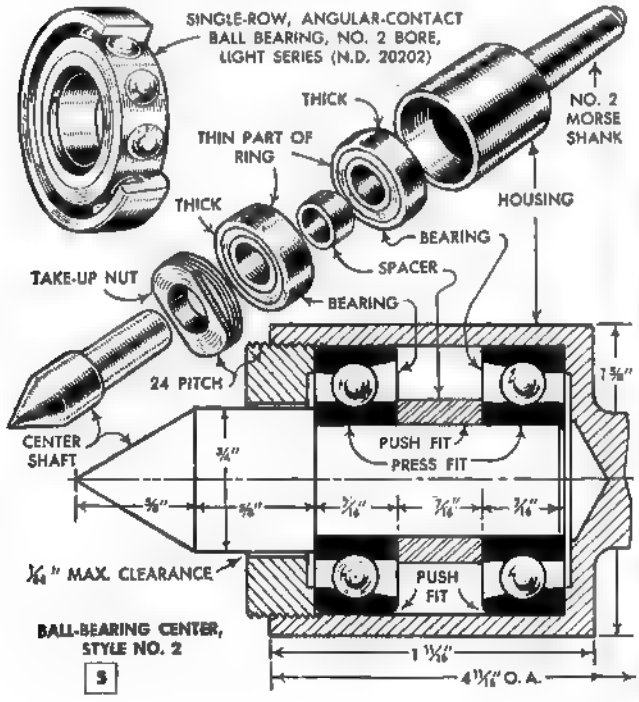


Of the two types given, the center detailed above is the easier to make. Although nonadjustable, it is as rigid as the adjustable one. Both types provide interesting projects in precision lathe work

OPERATIONS IN MAKING STYLE NO. 1—60° POINT IS TURNED AFTER UNIT IS ASSEMBLED

Boring requires precision work, so use the largest boring bar you have and make the final cuts with a feed of .002 in. per revolution. If you have had no experience with fitting ball bearings, it is worthwhile to turn a plug gauge .0004 in. less than the diameter of the bearing. When the gauge is a snug slide-fit inside the bored hole, you will know that the bearing will be a press-fit. Then rough-turn the center point. The shank can be turned with a taper attachment or by offsetting the tail center. However, it is possible to purchase Morse No. 2 shanks ready-ground. Fig. 4 shows how the 60-deg. point is finish-turned after assembly, using the compound slide.

Style No. 2 makes use of two single-row, angular-contact bearings of No. 2 bore, but No. 16 separable-magneto bearings, which also are the angular-contact type, are equally good. The general construction of the center is shown in Fig. 5. It will be noted that this center has a take-up nut for preloading, whereas the double-row bearing used for style No. 1 is factory preloaded. Start by turning the Morse-taper shank and housing from one piece of 1¾-in. cold-rolled steel, Fig. 1. Test it for fit in the tailstock spindle at an early stage by chalking the work and noting where the chalk rubs off. After the shank is turned, it is mounted in the headstock spindle for boring the housing, Fig. 6. Run in a light relief cut before threading it for the take-up nut. The bearings for this center should be a snug fit in the housing. Fig. 7 shows



BALL-BEARING CENTER, STYLE NO. 2

5

STYLE NO. 2 — BORING THE HOUSING

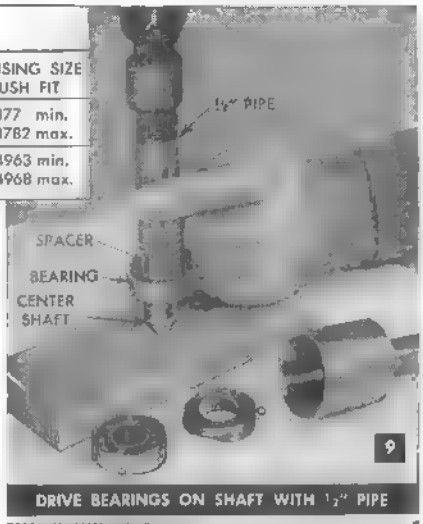
TURNING THE CENTER SHAFT

8 **BALL-BEARING DATA**

	BEARING BORE	SHAFT SIZE PRESS FIT	BEARING DIAMETER	HOUSING SIZE PRESS FIT	HOUSING SIZE PUSH FIT
NO. 2 BORE LIGHT SERIES	.5903 min. .5906 max.	.5905 min. .5908 max.	1.3775 min. 1.3780 max.	1.3771 min. 1.3776 max.	1.377 min. 1.3782 max.
SIZE 16 MAGNETO	.6296 min. .6299 max.	.6298 min. .6301 max.	1.4961 min. 1.4966 max.	—— ——	1.4963 min. 1.4968 max.

the center shaft being turned. The 60-deg. point is rough-turned at this stage and finish-turned when the unit is completed, Fig. 10. The center is locked in place by turning the takeup nut. Fig. 9 pictures the assembly. A short section of ½-in. pipe, faced at one end, makes a good driving tool for a bearing having a No. 2 bore. If the bearings are heated by placing them on a 60-watt lamp for about ½ hr., they will expand slightly and slide on the shaft easily. Heating the housing in the same way also will simplify assembly. Use a soft-grease packing in assembling both units. Except for the knurled surface, all parts of the centers can be given a high polish while they are chucked by using fine emery cloth dipped in oil and holding it against the work.

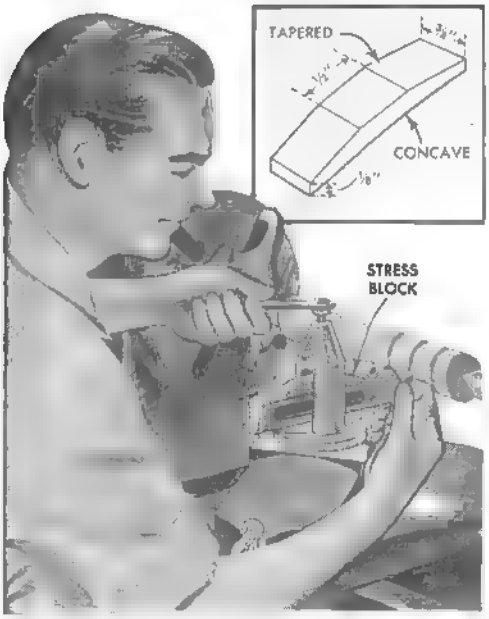
In making either style of center use utmost care in boring the housing and turning the center shaft. The table, Fig. 8, gives the minimum and maximum size of manufactured bearings, and the minimum and maximum diameters of work for press and push fits. It will be noted that tolerances must be held to ■ .0002 or .0003-in. limit. Ten-thousandths can be measured with an ordinary micrometer by dividing the small divisions by eye. Each small division, of course, represents .001 in.



DRIVE BEARINGS ON SHAFT WITH ½" PIPE

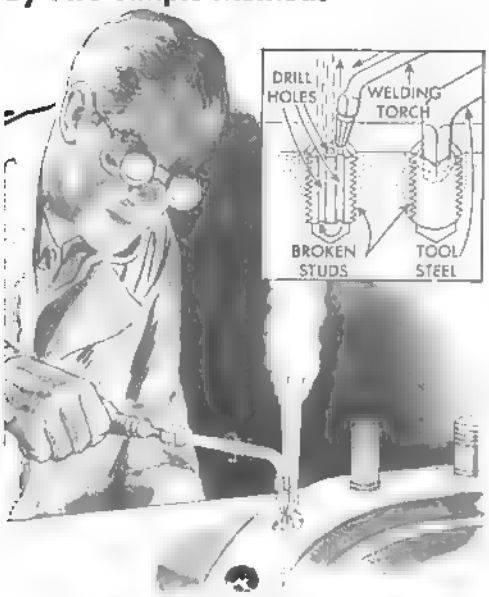
60° CENTER IS TRUED AFTER ASSEMBLY

Steel Stress Block Rides Holder in Tool Post to Reduce Bit Chatter



Precision lathe work such as finish-turning, boring and thread cutting to close limits makes it necessary to clamp the tool holder rigidly in the tool post to avoid chattering. In most cases, merely tightening the clamping bolt will not prevent this, because pressure from the bolt is centered only on a small area of the tool holder. However, this trouble can be corrected by using a stress block between the holder and the end of the clamping bolt to exert pressure over a greater area and consequently lock the holder rigidly in position. Naturally, the dimensions of the block must fit the tool post at hand; the dimensions given being for ■ 9-in. lathe. Make the block from tool steel and, after grinding it to the shape shown, harden it by heating to a cherry red and quenching immediately in oil. Note that the bottom of the block is slightly concave to provide a "spring" action which exerts pressure when clamped to prevent shifting due to vibration. The flat surface on the top of the block should fit the clamping bolt.

Broken Stud Bolts Removed By Two Simple Methods

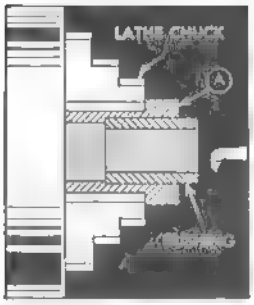


Here's a method which I have found very effective in extracting a broken stud bolt. First, drill four small holes lengthwise through the stud in a square pattern. Then direct the flame of an acetylene torch into one of the holes so that it will emerge from the others, as indicated in the left-hand detail. Heat the broken stud to a cherry red and let cool. The heating-and-cooling treatment will cause the stud to shrink slightly and make it easy to remove with slim-nose pliers.

Another method which works well when removing the broken part of a large stud is to drill a hole in the center of the stud and then drive the square and tapered end of a steel rod in the hole. The square corners of the rod will bite into the edges of the hole, and with the rod bent L-shape, the broken part can be backed out of the hole by merely swinging the tool.

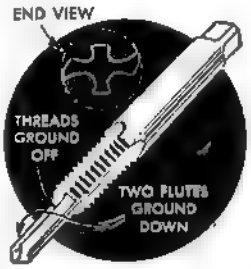
L. D. Barner, Waco, Tex.

Jig Aids in Boring Small Bushings



When it is necessary to enlarge the hole in a small bushing exactly concentric with the outside diameter, this boring jig will save time and afford greater accuracy than mounting the bushing directly in the lathe chuck. Bore a hole in a short length of brass or soft-steel rod to a push fit over the bushing, detail A. If you wish, leave a small internal shoulder to back up the bushing, but be sure it will not interfere with pushing out the work. Then, insert the bushing in the sleeve to project a short distance and chuck the assembly. Light cuts with the boring bar at a fairly high speed will do an accurate job.

Drill and Tap for Cast Iron Combined in One Tool

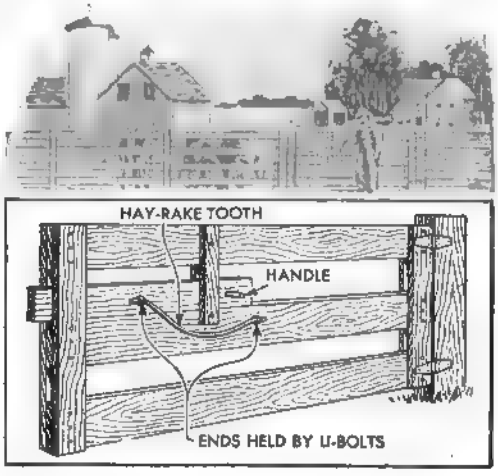


Made from a 4-fluted high-speed tap, this combination tool permits drilling and tapping through cast iron in one operation. Grind off the threads about halfway up from the bottom of the tap and grind off two opposite flutes, forming cutting edges so this portion of the tap will serve as a drill. To use, chuck the tool in a drill press and bore through the work until the threads are reached. Then tap the hole by turning in the remaining half of the tool by hand. This tool has been used successfully on cast iron up to 9/16 in. thick.

Charles N. Dyer, Kansas City, Mo.

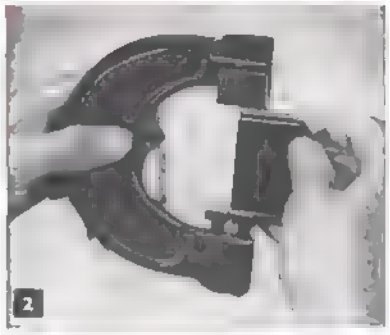
Spring-Action Latch on Farm Gate

Spring action provided by a hay-rake tooth closes the latch on this farm gate as soon as the handle is released. The latch is a heavy sliding member with a broomstick handle. One end of the tooth is attached to the latch and the other is fastened to a fixed cross member of the gate.



GAUGE BLOCKS
a standard for measurement


1

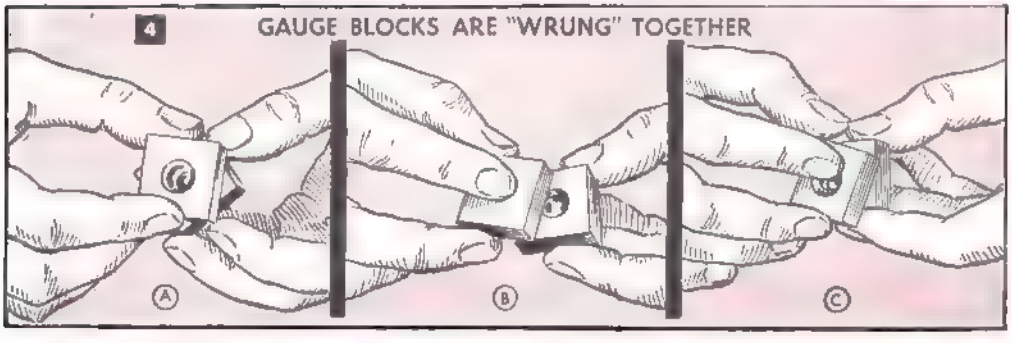

2

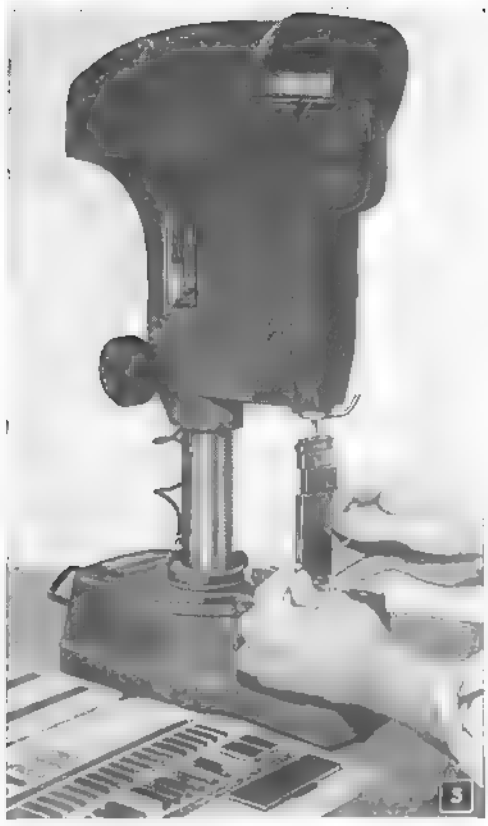

3

By Alexander Maxwell

PRECISION gauge blocks are used in all well-equipped shops to establish basic measurements for the purpose of laying out and producing parts of identical size. When critical measurements are necessary in laying out work on which machine operations are to be held within extremely close limits, the use of gauge blocks speeds up the preliminary operations and practically eliminates the reworking of jobs due to faulty scales or an error in taking readings.

When a number of blocks are to be used together to establish a measurement or to check the accuracy of other measuring instruments, they should be cleaned thoroughly with a soft tissue or chamois. Blocks from which the protective coating of grease or light oil has not been removed, cannot give accurate measurements. After cleaning, the blocks must be "wrung" together as in Fig. 4, steps A, B and C. Although easy to do, the process of wringing gauge blocks requires delicate finger work. First, the two blocks are placed together centrally, as in A, to prevent scratching one block with a corner of



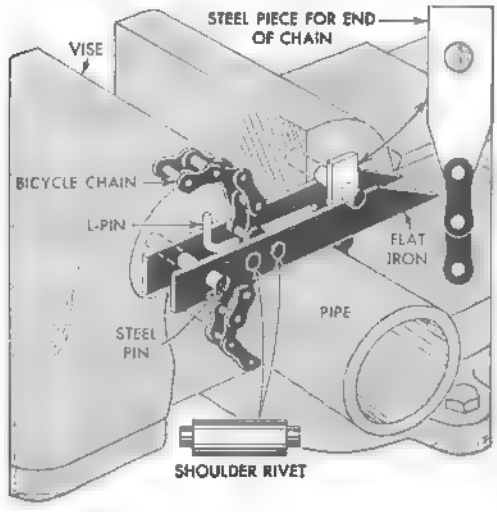


the other. Then the blocks are given a quarter turn and slid partially apart, as in B. Note that the blocks are only a little more than half out of engagement in this second position. In the third step, detail C, the blocks are slid back into full contact, being given a slight twist simultaneously so that the edges of both blocks are squared one with the other. This simple procedure excludes all air between the meeting surfaces and gives the complete metal-to-metal contact so essential to accurate work. Never leave the blocks wrung together for more than a few hours at a time. If left for longer periods it will be difficult to separate them. If it is necessary to use the same stack of blocks over a longer period of time, they should be separated and wrung together again. Always separate blocks by reversing the process of wringing together. Coat with grease when not in use.

Several common applications of gauge blocks are shown in Figs. 1, 2, 3 and 5. In Fig. 1, the height of the scriber point is being set accurately with a stack of blocks, both scriber pedestal and blocks being placed on a surface plate. Fig. 2 shows one method of setting an adjustable snap gauge, while in Fig. 3 a single block is used to check the accuracy of a small micrometer. Sensitive limit gauges are set with blocks as in Fig. 5. The accuracy of the setting is dependent on the scale reading and the sensitivity of the instrument.

Chain Attachment Adapts Bench Vise for Holding Pipe and Rod Stock

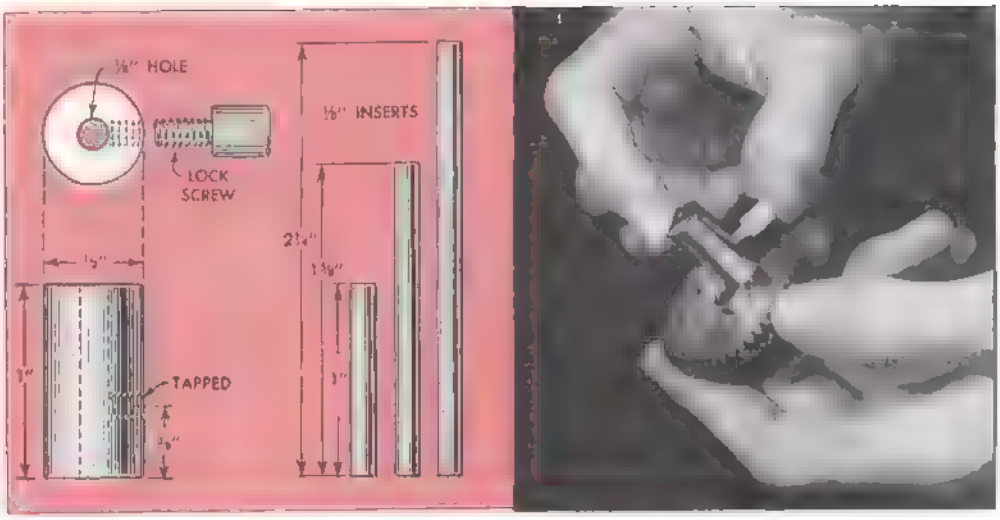
There's double duty to be had from a machinist's vise when it is equipped with this auxiliary attachment, as it then can be used for holding pipe and rod stock. The attachment is operated by movement of the vise jaws, and it pivots on a steel pin pressed in the side of the movable jaw.



Two flat-iron pieces are spaced apart by two shouldered rivets and a length of bicycle chain is passed between the two rivets and held with an L-pin which provides the necessary adjustment. The opposite end of the chain is riveted to a flat-iron link which fits over a pin in the rear jaw. Note that at the rear the flat-iron members bear against the underside of the pin. In use, the chain is wrapped snugly around the pipe and is held with the L-shaped pin. A slight pressure on the vise handle causes the chain to grip the pipe tightly and prevent it from turning.

Iron Pipe Protects Wagon Endgate

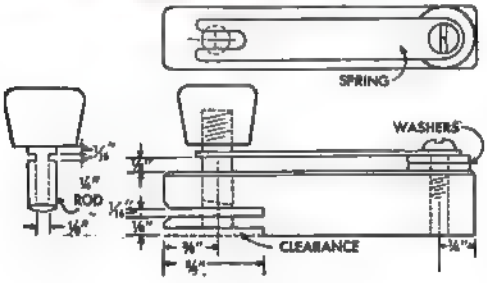
To prevent damage to the front endgates of his wagon when using it behind a mechanical cornpicker, one farmer mounted a length of iron pipe across the front of the wagon box above the endgate. He supported the pipe by ■ piece of flat iron bolted vertically to each side of the wagon so that it projected about 2 in. above the top of the wagon box. The flat iron is drilled to take an endgate rod which is passed through the pipe to hold it in place.



Gauge Measures With Accuracy of Depth "Mike"

Pieces of drill rod held in a sleeve of cold-rolled steel make up a depth gauge that has the accuracy of an expensive depth micrometer. In addition, the gauge is invaluable for close internal measurements. The sleeve is turned to a diameter of ½ in. and drilled through the center to take inserts of ⅛-in. drill rod. The ends of the sleeve are faced and polished so that its length is exactly 1 in., and a hole for a brass locking screw is drilled and tapped ⅜ in. from one end of the sleeve. The three inserts permit taking depth measurements up to 1⅞ in. and internal measurements from 1 in. to 2⅞ in. Longer inserts can, of course, be used. Depths in thousandths of an inch are obtained by measuring the over-all length of the unit with a micrometer and subtracting 1 in. from the reading. The micrometer reading of the total length of the insert and sleeve is used when taking internal measurements.

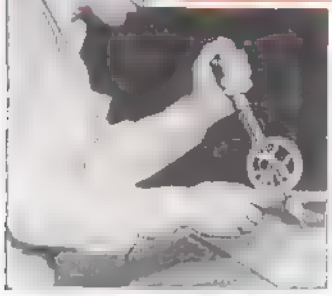
Inexpensive Paper Punch Is Satisfactory for Use in Home or Shop



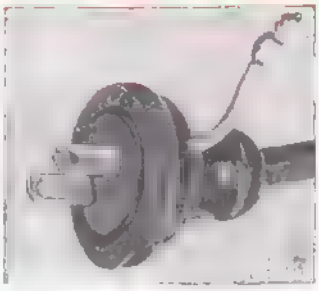
If occasional need to punch holes in paper for a loose-leaf binder does not justify the cost of a paper punch, you can make one inexpensively from a piece of ½-in. bar stock, a length of ¼-in. rod and a hacksaw blade. Shape and slot the bar as shown and drill it for the punch rod. Then drill and tap the opposite end of the bar for a machine screw which holds the spring in place. If the punch is to be mounted permanently on a desk or table top, drill this hole completely through the base and mount the punch with a wood screw. Thread the top end of the punch rod for a wooden knob and cut the lower end at a slight angle to provide shearing action. Cut two slots in the rod to take the spring, which may be an old hacksaw blade with the teeth ground off or a piece of phosphor bronze. Slot one end of the spring to fit over the rod and drill a hole in the other end. Finally, assemble the unit, using washers to raise the spring above the base.

¶To clean tiles around a fireplace, use an old cork dipped in paraffin.

CRAFT QUIZ

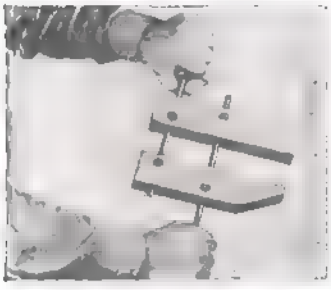


1. He is using a—
   (a) Hand drill (c) Ratchet drill
   (b) Brace (d) Post drill



2. Extra wire on this plug is for—
   (a) Three phase (c) Better contact
   (b) Ground (d) Special motor

3. Plain to see, this wood is—
   (a) Dappled (c) Quilted
   (b) Mottled (d) Flake figure



4. Wrong in this picture is—
   (a) Hands (c) Size
   (b) Jaw opening (d) Handles

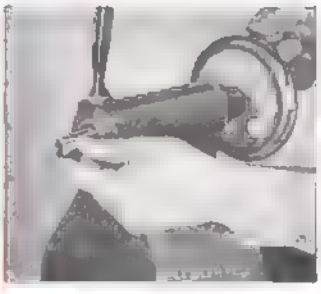
5. He works in a—
   (a) Pattern shop (c) Foundry
   (b) Gear shop (d) Cabinet shop

6. Interior panels in this trailer are—
   (a) No. 2 Common (c) Holly
   (b) Birch (d) Hemlock

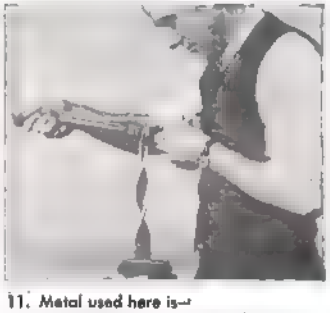
7. Cutting tool here is—
   (a) Spiral reamer (c) End mill
   (b) Brooch (d) Skiving tool

8. He hopes to be—
   (a) On the 59 (c) At the gate
   (b) On top (d) Swaging

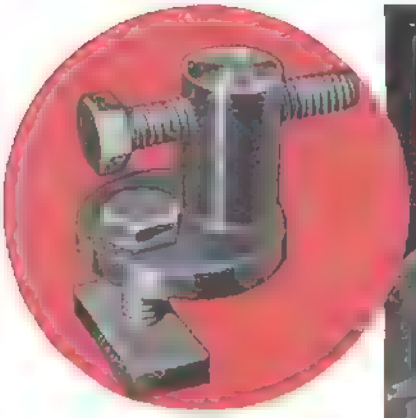
9. This worker is—
   (a) Stenciling (c) Offset printing
   (b) Silk screening (d) Block printing

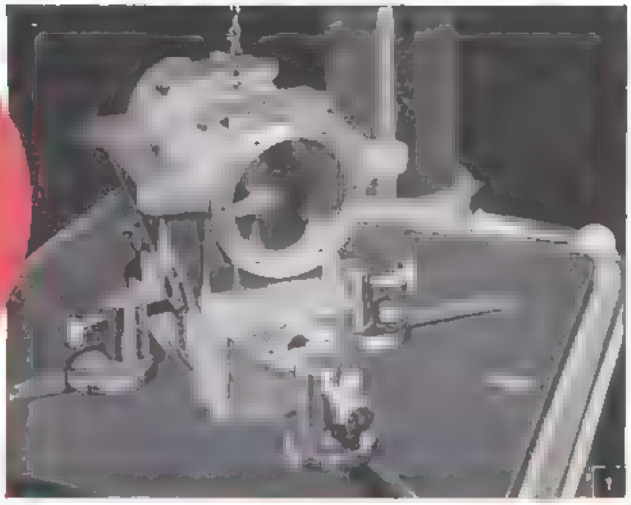


10. Getting ready to—
    (a) Turn wood (c) Taper
    (b) Turn metal (d) Use faceplate



11. Metal used here is—
    (a) Cast iron (c) Wrought iron
    (b) Foundry pig (d) Point 95 carbon

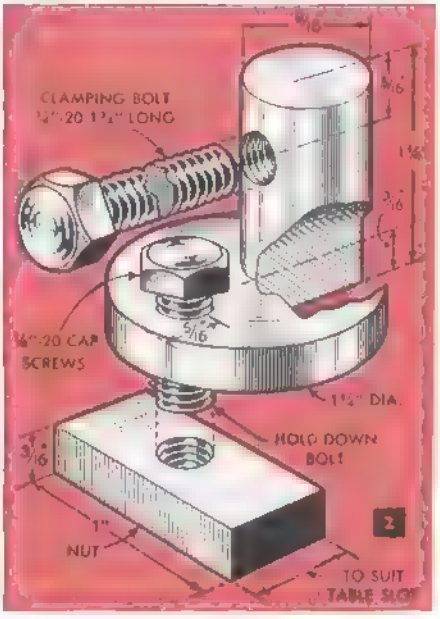




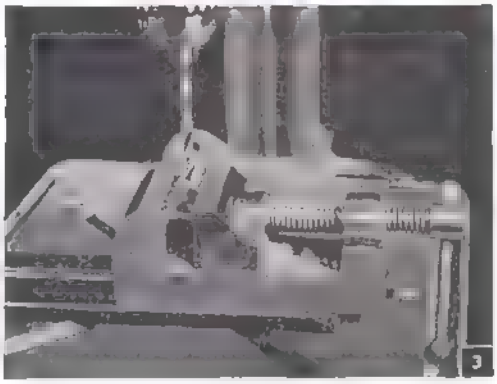
Quick-on DRILL-PRESS CLAMPS

By Will Thomas

These clamps are so designed that they drop into the slots in the drill-press table and can be tightened in a jiffy. They are especially handy when doing close work because it's never necessary to remove nuts and washers from bolts that project under the table. As you see in Fig. 1, the individual clamps can be set in various positions to hold work which is irregular in shape. Fig. 2 details one unit, and you can make as many as you need by simply duplicating parts and operations. To make duplicate clamps, chuck 1½-in. round cold-rolled stock off-center as in Fig. 4, carrying the outer end of the piece on the tail center. Turn to the dimensions given in Fig. 2 and you have four cam shapes as in Fig. 4. Saw these apart, then drill and tap for the clamping bolts, Fig. 3. The rectangular-shaped nuts, Fig. 2, are cut from ⅜-in. flat steel and finished by filing. Be sure that the nuts slip through the table slots. Drill and tap nuts exactly in the center so that strain is equalized when the bolts are tightened.



Clamps also can be used on a milling machine or lathe faceplate to hold irregular-shaped work



MILLING PRACTICE

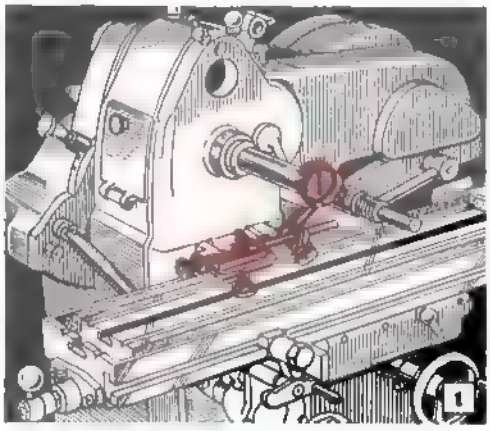
By H. J. Chamberland

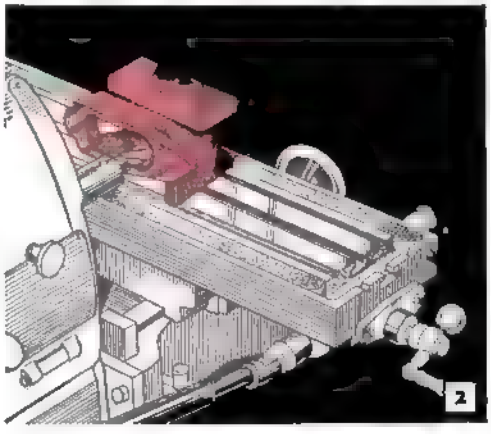
PRODUCING accurate work efficiently with a horizontal-spindle milling machine requires accessories that clamp and support the work rigidly on the machine table. These are necessary to resist the machining forces caused by the milling cutter removing material from the work, as these forces create vibration which results in chatter, the worst enemy of machining.

Maximum rigidity is attained when the table and the cutter are as close to the frame of the machine as possible. Before clamping the work to the table, the arbor, which is the "heart" of the milling machine, should be tested for runout with a dial indicator fastened to the table as in Fig. 1. Runout, which is the difference in parallelism between the arbor and the table and ways, should not exceed .002 in. A runout of .005 or .006 in. increases with higher spindle speed and, if permitted to exist, will ruin the arbor and its support bearing, shorten cutter life and result in poor work. Arbor runout is due to various causes, such as a bent arbor, resulting from taking excessively deep cuts or too fast a feed, wear in the arbor-support bearing and burrs on the arbor shank or in the tapered bore of the spindle. When making a cutter assembly, the arbor support should be positioned before tightening the arbor nut. If the arbor was true when tested with the dial indicator and the cutter is untrue after assembly, check between the collars for chips or dirt. If the cutter runs out radially, its bore is larger than the diameter of the arbor. The bearing in the arm support must be kept well-lubricated. When the arbor is removed, it should be cleaned thoroughly and when not in use it should be wrapped in cloth and placed in a drawer or cabinet.

Accessories for clamping the work consist of simple T-slot bolts and strap clamps, as in Figs. 5 and 6; a milling-machine vise, Fig. 8, or the more complicated indexing equipment shown in Figs. 11 and 12. The correct and incorrect locations of the T-slot bolt in relation to the work are shown in Fig. 3. The casting being machined internally with an end mill in Fig. 2 presents no clamping problem, as the flat surfaces of the casting rest on the table and the T-slot bolt projects through a hole in the work. The comparatively larger casting in Fig. 5, also being machined internally, is clamped at each end with a T-slot bolt and blocks. Milling forces in this case are much less than in Fig. 6 where they are increased by the wider cut being taken with a shell end mill. Where a number of different machining operations are to be done, the clamping naturally should be sufficient to take care of the heaviest load. An irregularly shaped casting, such as the one shown in Fig. 7, must be blocked at the bottom to align the work accurately and prevent distortion due to clamping. Machining forces are reduced to a minimum when the milling machine is used, as in Fig. 4, to lay out and center-drill holes that are to be drilled and bored later. Nevertheless, the high degree of accuracy involved still makes clamping a major factor.

The milling vise, shown in use for contour milling, Fig. 8, offers an efficient method of holding some types of work. The base of the vise is bolted to the milling-ma-

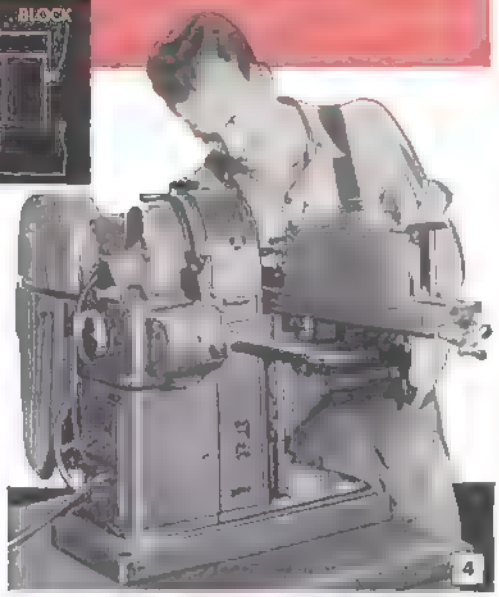




Above, a dial indicator is used to test accuracy of milling-machine arbor. Below, only one T-slot bolt is needed to hold small casting in place on table

chine table and the work is held between the vise jaws. Many such vises are equipped with a graduated swivel base which permits the work to be set at any angle to the table ways.

Two types of indexing equipment are in general use. These are the rotary indexing table, Fig. 11, and indexing heads, or centers, Figs. 9 and 13. The rotary indexing table is used for cutting straight or circular slots and grooves in flat work, usually circular in shape. The base of the indexing table is bolted to the milling-machine table and the work is clamped to the indexing table, which can be rotated and locked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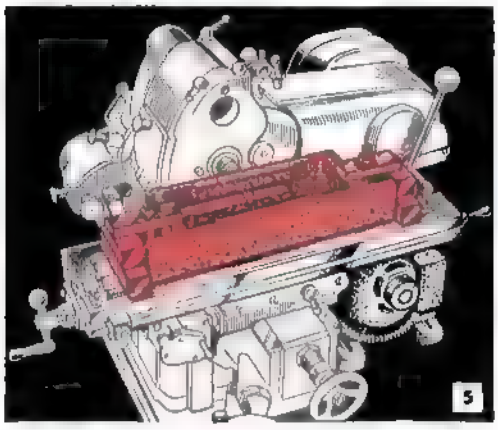
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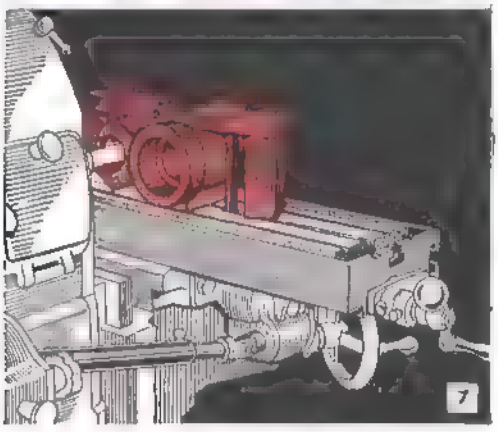
Large castings, as shown above and below, must be clamped down at each end. See Fig. 3 for the correct position of T-slot bolt in relation to the workpiece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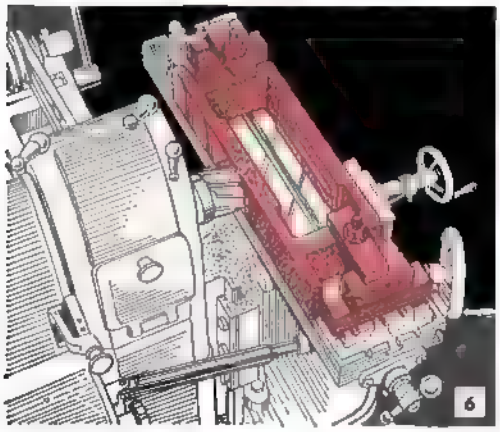
Above, irregularly shaped work is blocked at bottom. Below, milling-machine vise, which is bolted to top of table, is used to hold work for contour milling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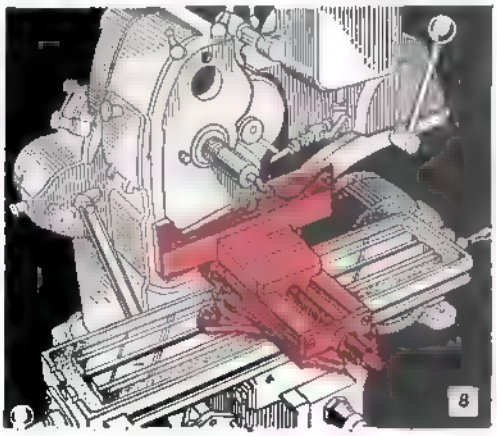
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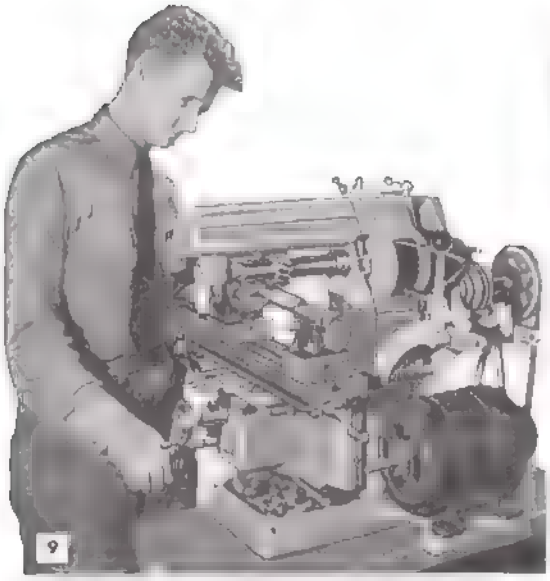
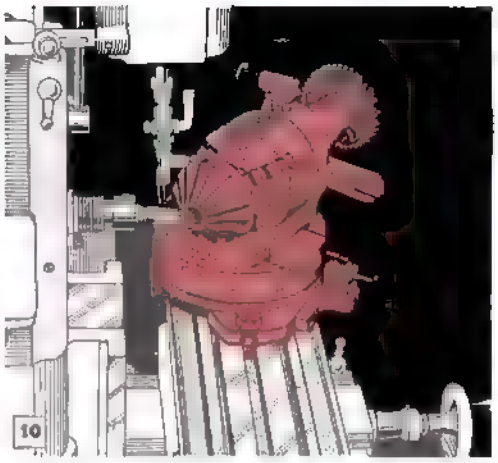
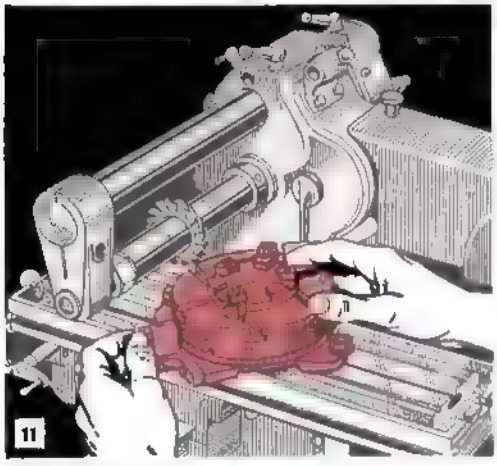
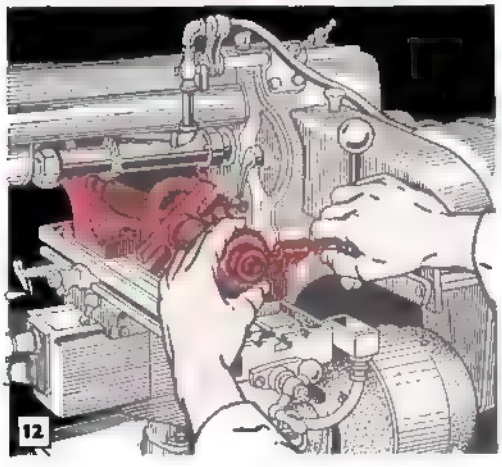




Accurate spacing for milling the teeth of an angular cutter is accomplished by mounting the work in a chuck fastened to an indexing center which, in turn, is bolted to an indexing table. Angular cutter is then heat-treated and ground



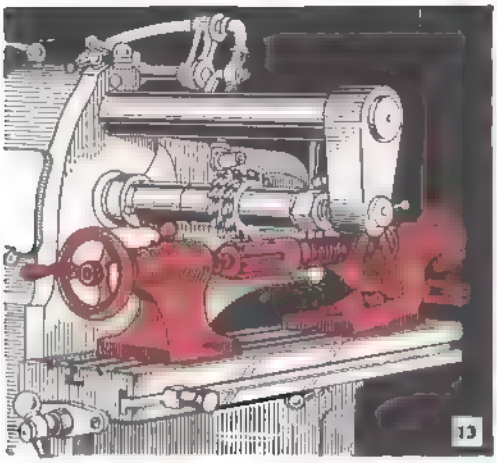
Above, work is clamped to a rotary indexing table which is bolted to milling machine. Below, gear is used to position work held between indexing centers



in place at the desired position. Indexing centers, which resemble the head and tailstock assemblies of a lathe, are used to position work, ordinarily cylindrical in form, for machining equally spaced grooves or surfaces across the periphery of the work. Milling splines on a shaft, as in Fig. 13, and making a gear, as in Fig. 18, are good examples. The method of indexing or positioning the work varies with the type of centers used. With the centers shown in Fig. 12, this is accomplished by rotating a gear fastened to the spindle of the headstock indexing center. A sliding pin, which engages the teeth of the gear, locks it in position. The lockpin support bracket is adjustable for various gear diameters, thus making accurate indexing merely a matter of selecting a gear on which the number of teeth is divisible by the number of spacings required on the work. The tailstock indexing center has a handwheel for adjusting its center longitudinally.

Angular indexing is accomplished by mounting a headstock indexing center, equipped with a chuck to hold the work, on a rotary indexing table. Fig. 10 shows this type of setup being used. Here the rotary table provides the angular adjustment and the indexing center permits accurate spacing to produce the teeth of an angular cutter.

On a production basis, teeth or flutes are milled with special-formed cutters. However, as an ample supply of these cuttters would be expensive, an assortment of standard cutters is, in most cases, sufficient for small shops. Gear cutting requires a formed milling cutter. Fig. 14 shows what is known as an involute spur-gear cutter.

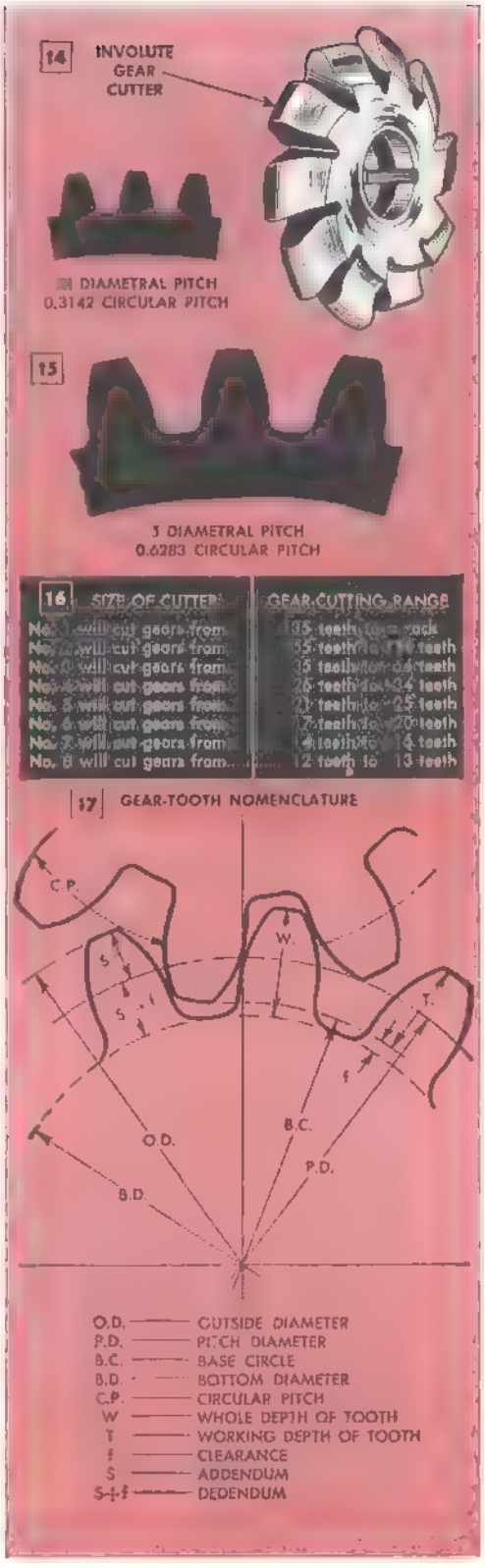


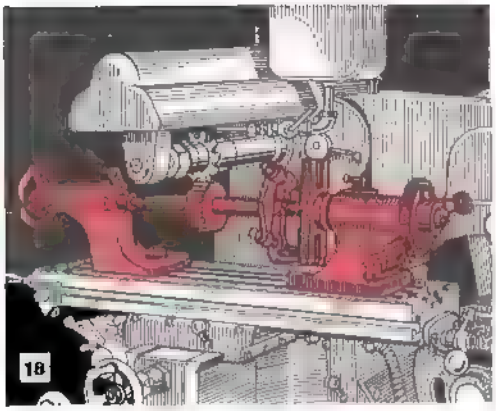
Milling spline on shaft with side milling cutters. Shaft held between indexing centers is rotated the required amount and locked in position for each cut

Eight different forms of these cutters comprise a set that will handle gear-cutting jobs within the ranges indicated in Fig. 16. These cutters are designed so their forms are correct for the lower numbers of teeth in each range, but if extreme accuracy is desired in the higher range, intermediate-numbered cuttters, such as 1½, 2½, 3½, etc., should be used.

Therefore, knowing the exact diameter and number of teeth required for a gear, the mill operator can readily select a cutter of the correct diametral pitch for the job. The exact diameter of a gear is neither the outside diameter of the gear blank nor the diameter at the bottom of the teeth. Instead, it is the pitch diameter, indicated in Fig. 17 as P.D. Circumference of this diameter is an imaginary line known as the pitch circle. To find the diametral pitch of a given gear, simply divide the number of teeth by the pitch diameter. The diametral pitch is not an actual dimension but the ratio between the number of teeth in a gear and its pitch diameter. For example, a four-diametral-pitch gear has four times as many teeth as it has inches of pitch diameter. The two details of Fig. 15 show the actual sizes of gear teeth of five and ten diametral pitch.

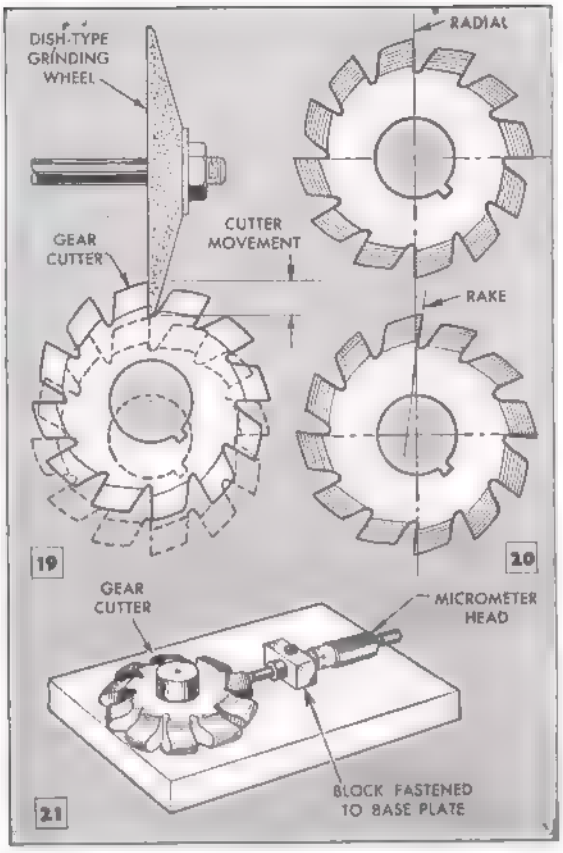
For accurate work, gear cutters must be sharp. Frequent sharpening by removing only a slight amount of metal is better than allowing the cutter to become so dulled that a single sharpening will depreciate it from 10 to 15 percent. In sharpening, only the faces of the cutter teeth are ground. This must be done on a machine equipped with a dish-type grinding wheel and a sliding toolholder that will permit cutter movement as indicated in Fig. 19. Gear cutters having radial faces, Fig. 20, upper





Typical setup for making gears with milling machine

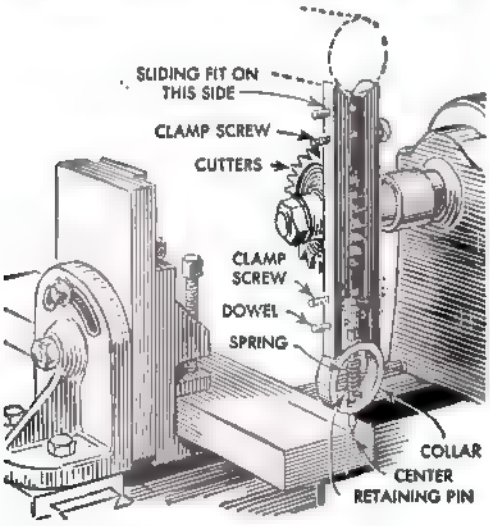
detail, must always be sharpened radially. Gear cutters with rake—faces back of center—as in Fig. 20, lower detail, must be ground to the rake angle stamped on the side of the cutter. After sharpening, the cutter should be checked for uniform depth of cut. A suitable fixture for checking this can be made as shown in Fig. 21. In use, the cutter is rotated and each tooth checked with the micrometer head. A variation of .001 in. is permissible between the extreme high and low teeth. Gear cutters, when properly sharpened, will produce duplicate work throughout their entire lives. Place gear cutters on individual racks when not in use. Never store loosely in a drawer.



Adjustable Fixture Locates Milling Cuts on Round and Flat Work

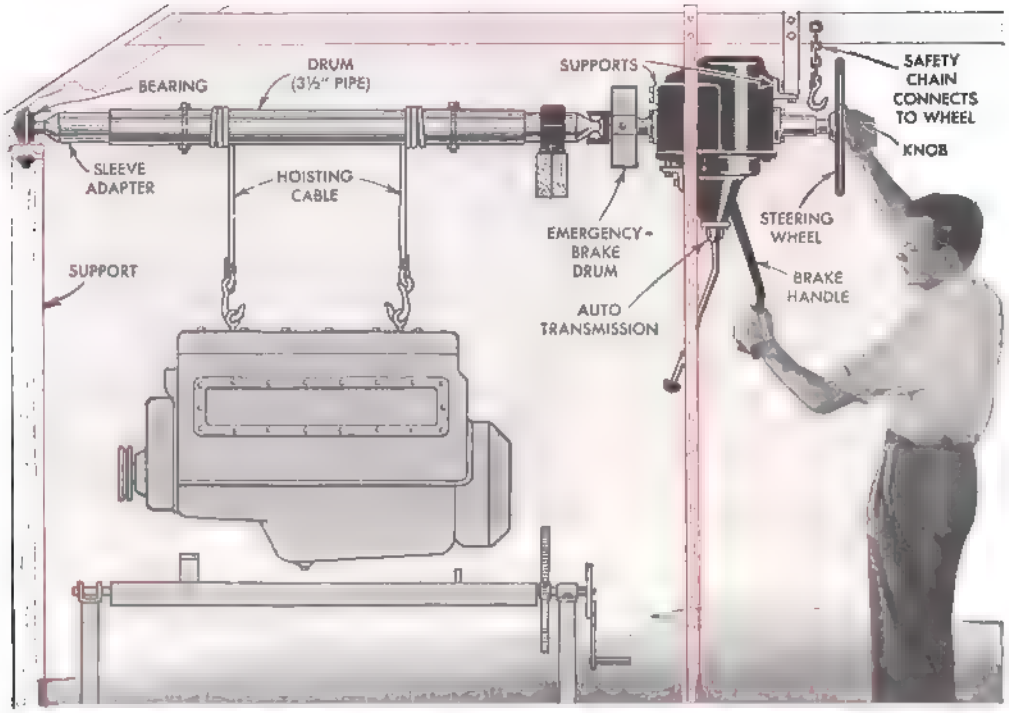
Milling cuts are accurately located on both round and flat work with this adjustable double-end fixture which is designed to clamp over a milling cutter in the position shown. One end of the fixture forms a vee to take round work while the other end contains a spring-loaded pointer for locating the cut on flat surfaces. Using the fixture for centering the cutter over a line scribed on the work, is merely a case of advancing the work until the line and the pointer coincide. This automatically centers the cutter over the line. When a keyway is to be cut in round work, the fixture is turned end-for-end and the work is positioned to cradle in the vee formed by the ends of the fixture. Construction is apparent from the drawing. Dowel guide pins and clamping screws are fitted in each end of the fixture which is made from two pieces of square bar stock beveled at the ends. The pointer, crosspinned by the dowel, passes through the exact center of a collar which is held by spring tension against the end of the fixture.

H. Moore, Leeds, England.



¶To detach a badly corroded car-battery terminal from the battery post, drench with boiling-hot water to remove the corrosion. Then, loosen the nut, spread the terminal with a screwdriver and lift off.

Transmission Operates Variable-Speed Hoist



By utilizing an old auto transmission of the type having the emergency brake mounted on the drive shaft at the rear of the housing, you can build a powerful hoist for use either on the farm or in the garage. The detail above shows a typical installation with the transmission mounted upside down so that both the shift lever and the emergency-brake lever can be reached easily. The hoist is operated by an auto steering wheel attached to the forward drive shaft of the transmission. A chain with a small hook at one end is attached to the supporting framework so that when a load is raised the chain can be hooked to a spoke of the handwheel. The drum is a length of 3½-in. pipe which is slipped over the auto drive shaft and centered by means of sleeve adapters. After fitting, the parts are welded in place for maximum strength. The inner and outer ends of the drum shaft are supported in pillow-block bearings as shown. If regular pillow blocks are not available, suitable bearings can be made by cutting short lengths of pipe of the correct inside diameter and welding to lengths of flat iron to form bases. Drill the flat-iron bases so that the bearings can be attached to the frame with bolts.

Peter P. Ruppe, East Detroit, Mich.

Tape Seals Hole in Grinder Spindle To Keep Out Abrasive Dust

When using a tool-post grinder for external work, it's a good idea to seal the hole in the tapered spindle with a piece of cellulose tape. This will keep abrasive dust from entering the taper and preventing the internal grinding quills from seating properly. The cellulose tape is removed quickly when the spindle is to be used.

¶Duplicator stencils, which are used and kept on hand for future use, produce better copies if they are rubbed on both sides with a little light machine oil before storing.

SERVICING WHEEL BEARINGS

Like any fine mechanism, wheel bearings need attention to withstand constant use. Proper adjustment, cleaning and lubrication keep them in top condition

By Phil Ruskin

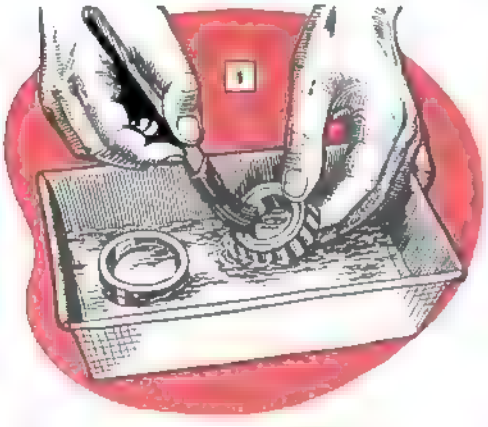
Kaiser-Fraser Corp. photo

Testing front-wheel bearings for looseness by rocking wheel. Do not mistake kingpin movement for wheel-bearing looseness

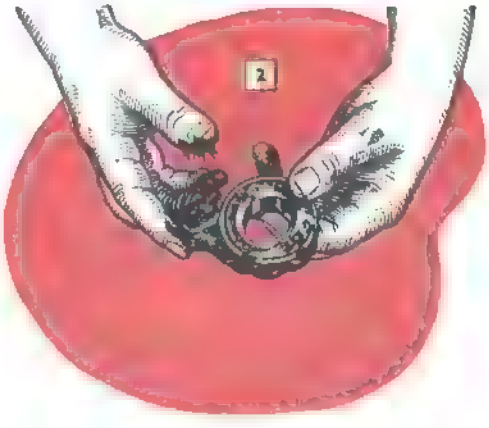
ROLLING contact bearings on each of the four wheels support the entire weight of a car. These bearings are expertly designed and engineered for extremely long service, and with only occasional attention they usually last for the life of the car. Under ordinary conditions, it is advisable to remove the wheels and inspect and clean the bearings at least once a year—oftener under extreme conditions.

The most common causes of bearing malfunction are: (1) rust due to worn or defective seals or condensation inside the housing; (2) worn, galled or abraded surfaces resulting from too loose a fit or dirt lock; (3) broken or bent inner ring, shields, seals or separators caused by improper or careless installation, and (4) damaged raceways, balls or rollers due to dirt or pitting by corrosion. Badly discolored balls and races indicate inadequate lubrication. Dirt or pitting by corrosion is indicated by a general roughness, and excessive looseness or end play is evidence of lapping by dirt or abrasive. Parts are a dull-gray color when lapped or abraded by dirt.

The principal parts of a ball bearing are shown in Fig. 4. Variations of this bearing will be found in the different makes of cars, but basically they are the same. Wear is virtually absent unless foreign matter finds its way into the bearing. However, any



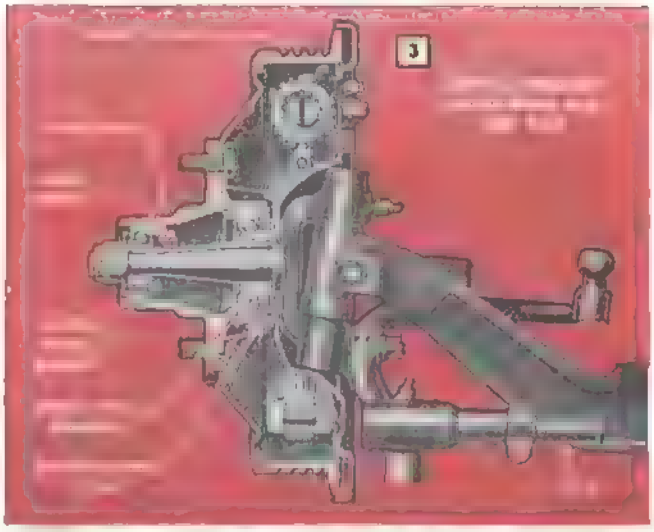
Soft brush assists cleaning of bearings in gasoline. After washing, handle parts only when necessary



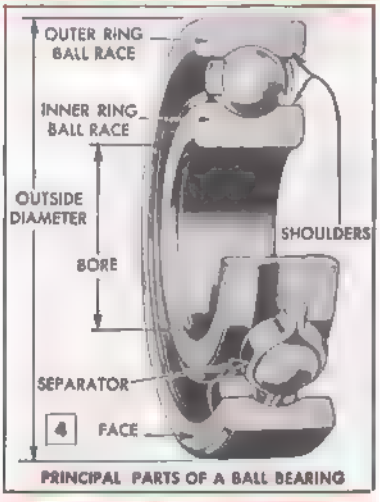
Bearing is packed with wheel-bearing grease made especially for purpose. Substitutes should not be used

abrasion or injury to the surfaces may lead to bearing failure, and hitting or dropping a bearing is likely to damage it beyond repair. Also, incorrect kind or amount of lubricant may cause heating or corrosion.

Fig. 3 shows a typical bearing arrangement for the front wheels. To service these bearings, jack up the wheel and remove the ornamental cover and hub cap, if any. Next, remove the cotter pin from the spindle nut and unscrew the nut. Pull the wheel off slightly to loosen the outer bearing and then push the wheel back in place. Carefully remove the outer bearing and place it on a clean piece of paper. The wheel can then be completely removed from the axle. Now, slip the inner bearing and grease retainer from the hub and place them on the paper also. After this, all parts, including the wheel hub and axle spindle should be thoroughly washed in white gasoline and allowed to dry, Fig. 1. Do not handle the bearings more than necessary after cleaning, as perspiration tends to corrode them. Inspect the grease retainer and brake assembly for grease leakage. As this retainer keeps the lubricant within the bearing area and away from the brakes, it should seal tightly. Inspect the bearings for wear and damaged balls or rollers and check for play between the balls and races. However, do not spin the bearing before it has been lubricated. Coat the bearings and the axle spindle with wheel-bearing grease, Fig. 2, but do not use ordinary chassis lubricant or other substitutes. If new bearings are necessary, be sure to get duplicates of the ones being discarded.



General Motors Corp. photo



PRINCIPAL PARTS OF A BALL BEARING

To reassemble the parts, first press the inner bearing and grease retainer into the hub. Mount the wheel on the spindle, being careful not to damage the grease retainer, and insert the outer wheel bearing, applying the spacer washer and castle nut. Rotate the wheel slowly, tighten the nut until the wheel just binds and then back off the nut slightly to insert the cotter pin. Check for bearing looseness by rocking the wheel, but first block the kingpin or have someone watch it, so that kingpin movement is not confused with bearing looseness. With the bearing properly adjusted there will be a slight drag when the wheel is turned slowly by hand. When the adjustment is right, secure the cotter pin.

The rear-wheel bearings, Fig. 5, do not require attention as frequently as those on the front wheels. The parts of the rear-wheel assembly are cleaned and the bearing checked in much the same way as those of the front wheel. However, a wheel puller will be necessary to remove the wheel. Probably a puller will also be needed for the bearing. If the bearing is lubricated by high-pressure grease fittings, be careful not to apply too much grease.

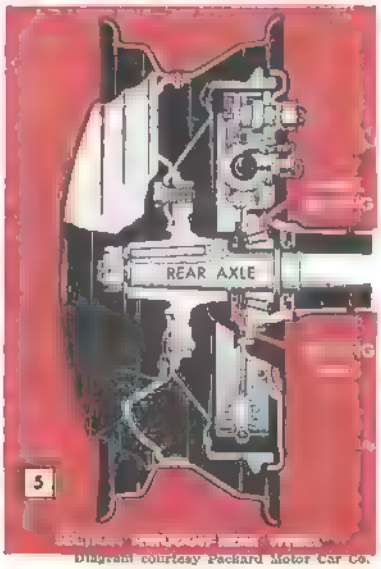
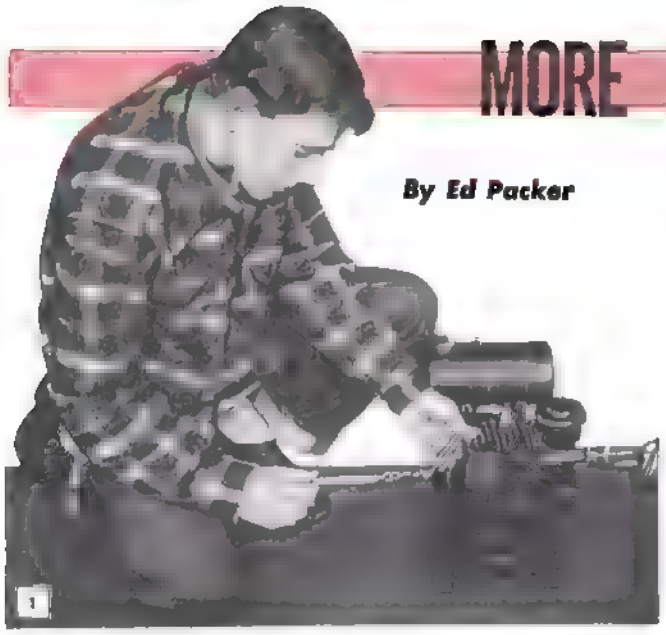


Diagram courtesy Packard Motor Car Co.

MORE POWER FOR

By Ed Packer

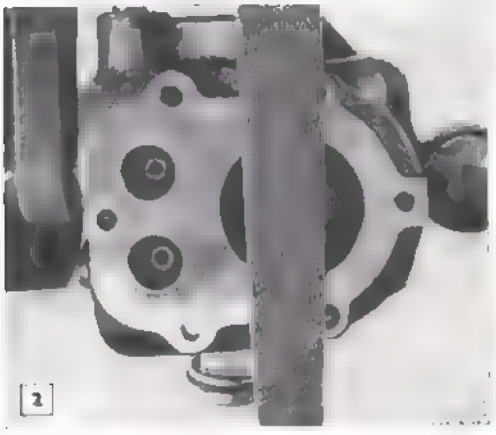
New power applications prove the adaptability of small one-cylinder engines for use on almost any type of small power-driven machine. These uses emphasize the need for careful attention to a special service schedule that will keep these engines operating at top efficiency over a long period of time



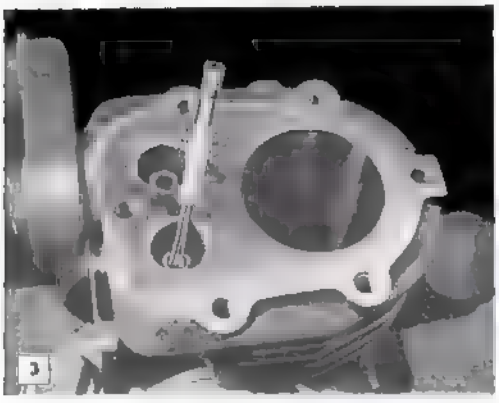
If a torque wrench is not available, use a socket wrench and spring scale to tighten cylinder-head bolts

SINGLE-CYLINDER engines of the air-cooled type are designed to operate at relatively high speeds and this means that all working parts, especially the piston rings and valves, must function perfectly at very high temperatures over long periods of time. Special care and servicing on a regular schedule are necessary to keep the engine in condition to deliver top performance. Most of this simple servicing can be done by the owner.

More power and smoother operation often result from cleaning out the carbon. These engines have small parts and care must be taken when dismantling and reassembling not to cause permanent damage. Use a torque wrench when tightening cylinder-head and crankcase bolts to assure uniform tension. Another method, used where a torque wrench is not avail-



Distorted areas, due to head bolts drawn too tightly, can be located by passing a file lightly over the head flange. Careful filing removes the high places



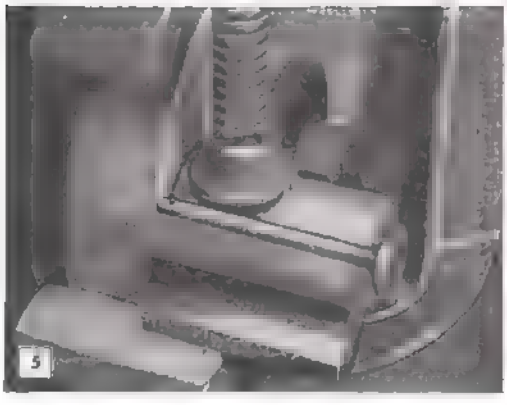
Lower left, check valve guides for clearance with an expanding ball gauge. Below, measure valve stem and gauge with a "mike" to get the actual clearance

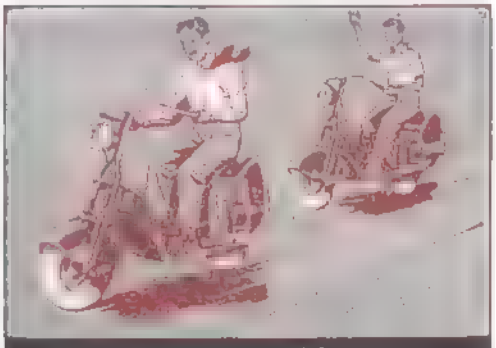
able, is illustrated in Fig. 1. Here the mechanic is drawing each bolt down to the same tension by means of a common socket wrench and a spring scale, which is pulled at exactly right angles to the wrench. The manufacturer's recommended torque should be followed.

Fig. 2 shows a simple way of checking the top of a cylinder block for distortion. Pressing down at the center of contact as the file is moved lightly across the top of the block, reveals the high spots. Such distortions can seriously affect the operation of the valves, causing compression leaks and rapid wear of the valve stems and guides. When reassembling the head to the cylinder block, always use a new gasket and be especially careful to draw the head bolts to a uniform tension. If the engine manual gives the order in which the bolts are to be tightened, it's important that this be followed.

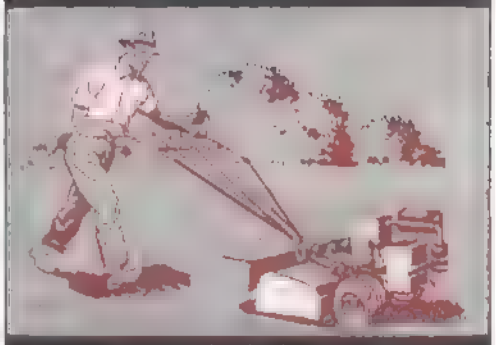
It's a good idea to keep a record of the engine compression. When available, use a compression gauge like that shown in Fig. 6. Two things happen to engine compression in the course of normal use. As carbon accumulates, compression builds up and the engine begins to run hot and knock under load. When there has been a 10-lb. rise in the compression, it usually is wise to clean out the carbon. Following this rise in compression there may be an actual drop in pressure as carbon interferes with the normal action of the valves and rings. Usually this indicates the necessity of servicing the valves. In connection with valve servicing, here's a trick that is worth knowing. Before the engine

As many small engines do not have adjustable tappets, the ends of the valve stems are ground to give correct clearance. Use a V-block as shown below

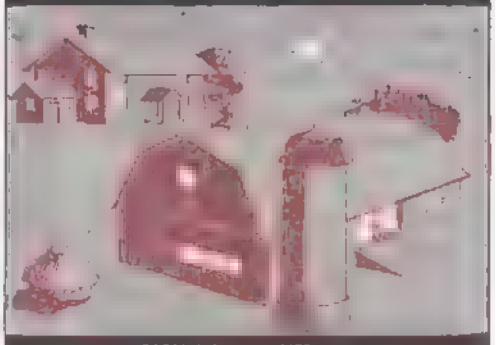




FOR MOTOR SCOOTERS



GARDEN TRACTORS

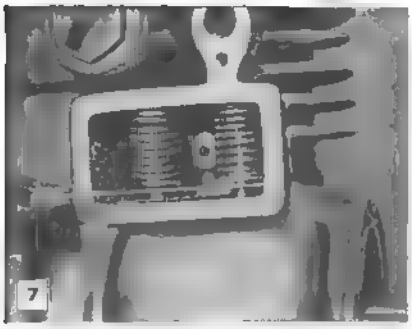


FARM LIGHT PLANTS

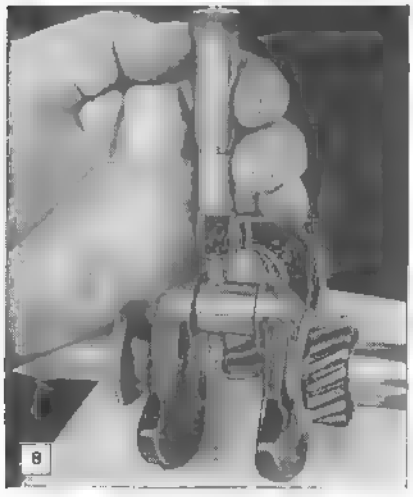
AND CONTRACTORS' TOOLS

Before disassembling an engine, check compression with a dial gauge such as shown above. It gives a true reading

Engines operating in dusty conditions, such as on garden tractor at the left, usually need more frequent attention



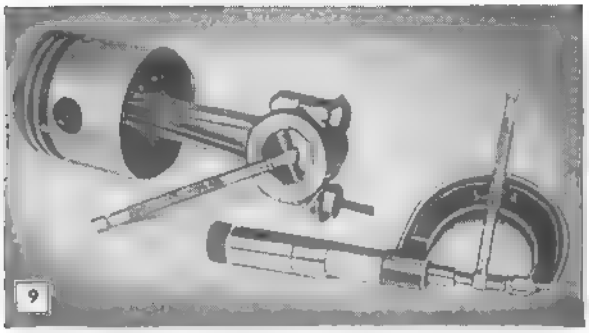
Above, check and double check valve clearances with a feeler gauge. Below, whenever engine is disassembled measure the crankpin

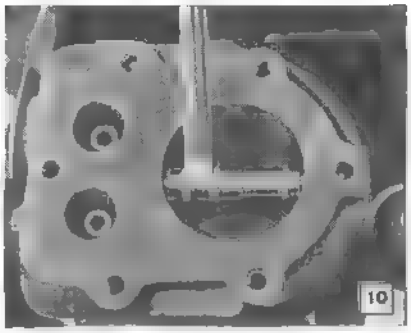


is opened, allow it to idle on closed throttle for a minimum of 5 min. Then, shut it off without accelerating. As the engine is disassembled, the intake valve should be closely inspected for signs of oiliness. This condition indicates a need for new valve guides. Unless one has the necessary equipment for this work, the engine should be taken to a qualified mechanic. One of the tools needed for a valve job of this nature is a precision expanding ball gauge of the type shown in Fig. 3. This instrument accurately checks the inside diameter of each valve guide, giving readings in thousandths of an inch, Fig. 4. By comparing this reading with the valve-stem diameter, also being checked in Fig. 4, the actual clearance is easily determined. In reaming new guides, follow the manufacturer's service manual.

Valve clearance, that is, clearance between the stem and tappet, controls timing of the valves. Too little clearance will cause the valves to burn and pit. In most "one lunger" engines there is no adjustment on the tappets so the valve stem must be ground to give the correct clearance specified in the service manual. To do this, clamp a V-block to the grinder tool rest, as in Fig. 5, for facing off the end of the stem. Most service manuals on the small engines call for an exhaust-valve clearance of .007 to .009 in. with the intake valve set for .005 to .007-in. clearance. Keep in mind that refacing valves or reseating always reduces valve clearance. Always double check when measuring clearances, Fig. 7, to be sure that the piston is on top dead center of the compression stroke.

After the valves have been serviced, it may be found that the engine still lacks power. This can mean a scored cylinder wall or badly worn rings.





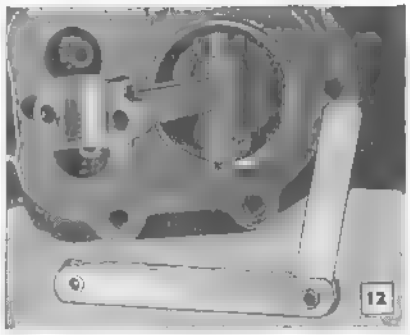
Left, use a telescoping gauge to determine the exact inside measurement of the connecting-rod bearing. Then mike the gauge to get the true diameter. Right, check diameter of cylinder bore at top and bottom

If the engine is disassembled for the purpose of installing new rings or other parts, check the crankpin and connecting-rod bearing. If the micrometer, Fig. 8, shows an out-of-round or tapered condition of the pin up to .001 in. the shaft is still serviceable. But if the wear is greater than this, it may be necessary to machine the pin and install an oversize connecting-rod bearing. When reassembling the engine, see that the connecting-rod bearing is not set up too tight. One way of checking this bearing is to use the telescoping gauge, as in Fig. 9, and then measure the gauge with a micrometer. The clearance should not be less than .0005 in. The crankshaft bearings, if of the plain-bearing type, should have similar clearances.

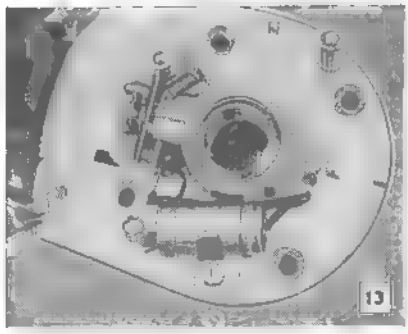
Checking the cylinder bore with an inside micrometer, as in Fig. 10, is always desirable, but a fairly good check of cylinder conditions can be had by running the piston up and down in the cylinder, trying feeler blades between the cylinder and the piston skirt. The measurement is always made between the skirt of the piston and the lower half of the cylinder wall. Clearances ranging to .0045 in. are generally satisfactory on small engines of the air-cooled type. When measuring the diameter of a new or used piston, the measurement always should be made at right angles to the wrist pin, as in Fig. 11. Some pistons are cam ground to allow for extra expansion of metal at the center.

When installing new rings, first roll them around the ring grooves to be sure that they are free. This play should not exceed .002 in. Now slide the piston, without the rings, upside down into the cylinder bore. To test the rings for end gap, place them, one at a time, on top of the piston skirt, as in Fig. 12. Tap each ring lightly with the piston from below to be sure that the ring stands square with the bore. The ring gap for these small engines should range between .007 and .017 in. As the rings are checked for end gap, they should be laid out carefully in order that the ring with the greatest gap goes in the top ring groove, and the ring with the least gap goes in the lowest ring groove. When reassembling these parts, oil liberally. Before reassembling the magneto, check the breaker-plate assembly, Fig. 13, and be sure that the condenser-mounting screw is tight.

When checking piston diameter, always place the mike at right angles to the wrist pin

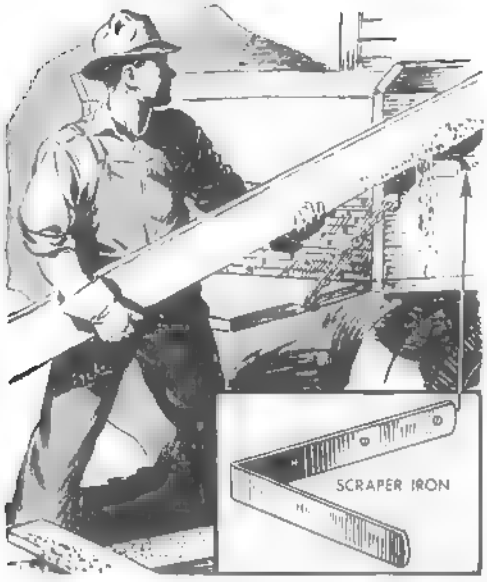


To check the end gap of rings, place them in the cylinder on top of the piston skirt



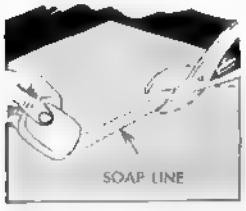
Renew worn parts of the distributor and be sure the condenser connections are tight

Scraper Iron on Side of Truck Cleans Concrete Form Boards



To simplify the cleaning of cement from concrete form boards while loading them, one contractor uses a piece of flat iron bent at right angles and screwed to the side of the truck body as indicated. The workmen inspect the boards when loading them and those that have dried cement on the edges are passed over the scraper to clean them. The scraper iron should not extend far enough beyond the body of the truck as to constitute a traffic hazard.

Soap Mark Lubricates Sheet Metal When Cutting It With Shears

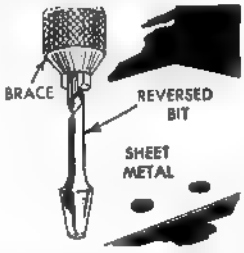


If you have some heavy sheet metal to cut with shears, the job can be made easier by marking the line of the cut on the metal with a bar of soap. This will serve as a lubricant so that the shears will cut the metal with less effort.

Keeping Circular Saw in Balance

When a circular saw runs untrue and out of balance often the trouble is due to play between the mandrel and the hole in the saw blade. Jointing seldom improves this condition unless care is taken to place the saw on the mandrel in the same position each time it is removed. However, by putting an identifying mark on the blade and keeping it uppermost when placing the saw on the mandrel, the relation between the mandrel and saw is always the same and, after jointing a few times, the saw will run true and in balance. The same adjustment may be applied to dado heads, cutoff wheels and other attachments used on the saw mandrel.

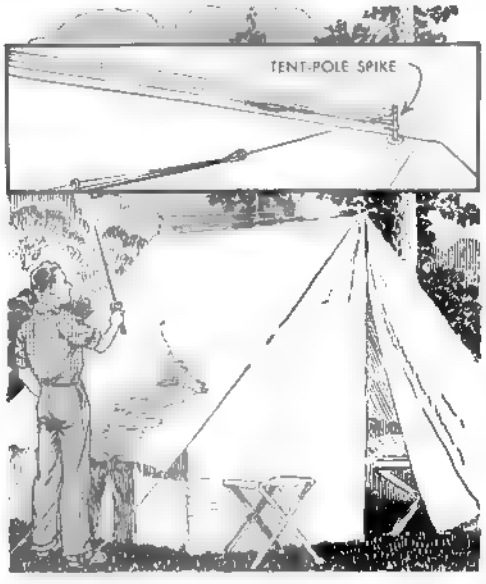
Twist Drill in Brace Used as a Reamer



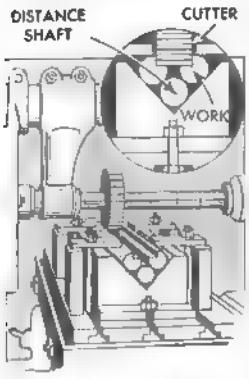
Having a number of holes in sheet metal that were too small, and having no reamer at hand to enlarge them, one tinsmith did the job with a twist drill. This was reversed end for end in the chuck of a brace so that the shouldered end of the drill could be used as a reamer. The point of the drill should not be inserted fully in the chuck of the brace or its point will be dulled.

Projecting Spikes on Tent Poles Serve as Fishline Drying Reel

One sportsman who always dries his fishlines each time that he has fished with them, uses the spike ends of his tent poles as a reel for this purpose. It is a simple matter to wind the line around the ends of the spikes projecting above the ridge pole, using the casting rod to weave the line back and forth.



Milling Setup Doubles Output



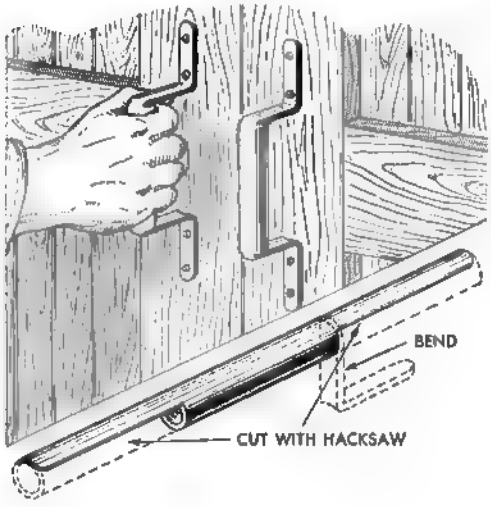
Two identical cuts can be milled in the time it takes to make one cut, if the work is clamped as shown and a straight-faced cutter is used instead of an angular one. Here, the idea is used to mill shallow V-grooves in shafting. Two pieces of work are placed in a V-block and supported by a third piece labeled "distance shaft." As the distance shaft determines the spacing of the work and the depth of cut, the size of the shaft and cutter must be such to permit milling an identical groove in each shaft. Mounting two pieces of work in this manner also permits the work to be clamped along each side and thereby provides free passage for the cutter along the entire length.

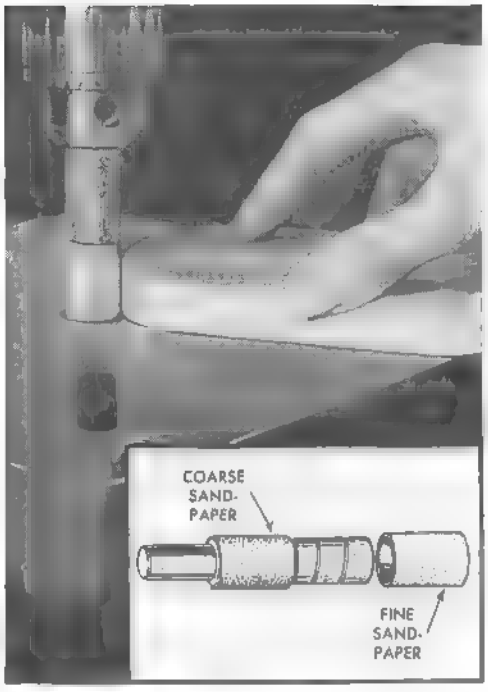
H. Moore, Leeds, England.

Scrap Pipe Makes Sturdy Handles For Shed and Barn Doors

Excellent, inexpensive handles for the doors of barns and other out buildings can be made from lengths of pipe by sawing and bending them as shown. The finished handle has a round, comfortable grip and its size, of course, is determined by the pipe used. Holes are drilled in the flattened ends to permit fastening the handles to the door with screws.

John Krill, North Lima, Ohio.

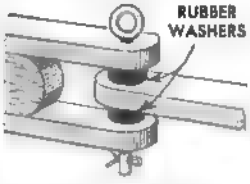




Drill-Press Sanding Sleeve Does Coarse or Fine Work

Both coarse and fine sanding may be done on the same drill-press sanding drum without changing sleeves, if sleeves of two different grit sizes are cut in half and a piece of each is slipped on the drum. Raising or lowering the spindle and locking it in place brings either grit into working position. If the sanding drum is too large to pass through the hole in the drill-press table, a piece of wood the same thickness as the height of the lower sleeve section will serve as a platform to elevate the work.

Eliminating Trailer-Hitch Rattle



Rattling of the pin-type hitch between a tractor and wagon is eliminated by placing rubber washers on the clevis pin so that one is on each side of the drawbar. Suitable washers can be fashioned by making a hole through the center of two rubber shoe heels.

Torn coat linings, due to hanging the coat on a nail in the shop or barn, can be prevented by driving the nails lengthwise through a cork. Long, small-diameter corks are most suitable for this purpose.

BEFORE YOU BUY A MODEL

It's a logical precautionary measure to learn to recognize fine workmanship and materials even though the manufacturer's reputation indicates merit of a model gasoline engine

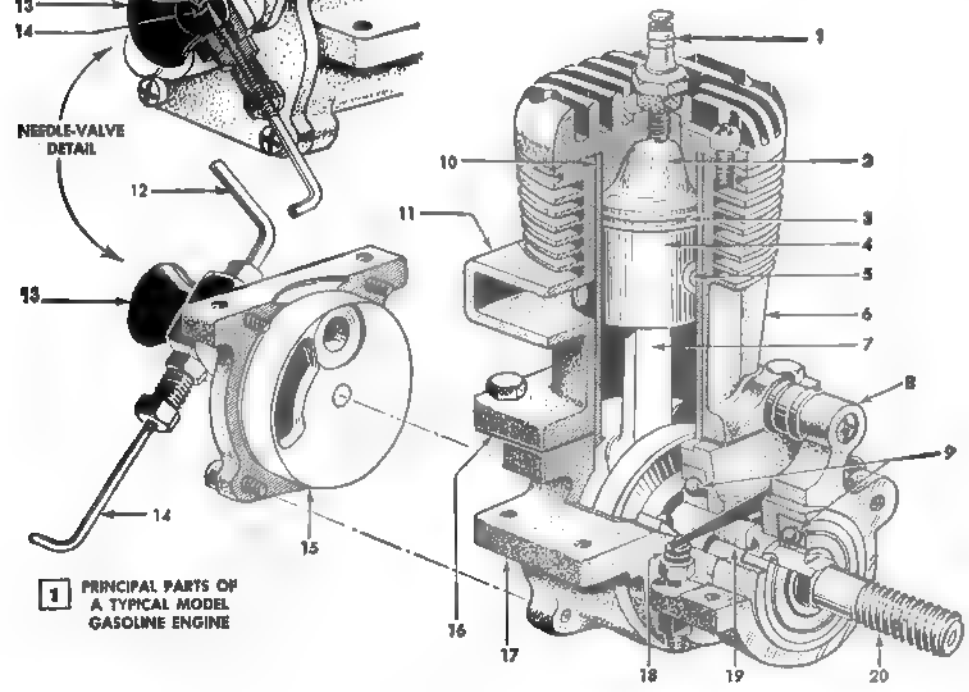
By Robert Lloyd Brown

IN SELECTING a miniature gasoline engine for a model airplane, racing car or boat, the reputation of a particular engine usually can be depended upon. Nevertheless, if you want to make sure you get the engine suited to your purpose, keep in mind several important points which considerably affect the performance of this type of engine. The principal parts of a typical model gasoline engine are identified and located in Fig. 1.

Cast-iron cylinder blocks, either with or without steel liners, or steel cylinders are preferable in certain applications to aluminum-alloy blocks with steel liners. The cast-iron cylinder takes a better internal wall finish, affording a higher compression ratio, and it runs cooler than steel. However, the steel cylinder has superior strength for a given wall thickness. Steel pistons are preferable to the cast-iron or aluminum-alloy types because they have greater strength, better finish, uniform shape and lighter weight. The wrist pins may be either of bronze or steel, but brass pads should be inserted in the ends of the wrist pins to prevent scoring of cylinder walls.

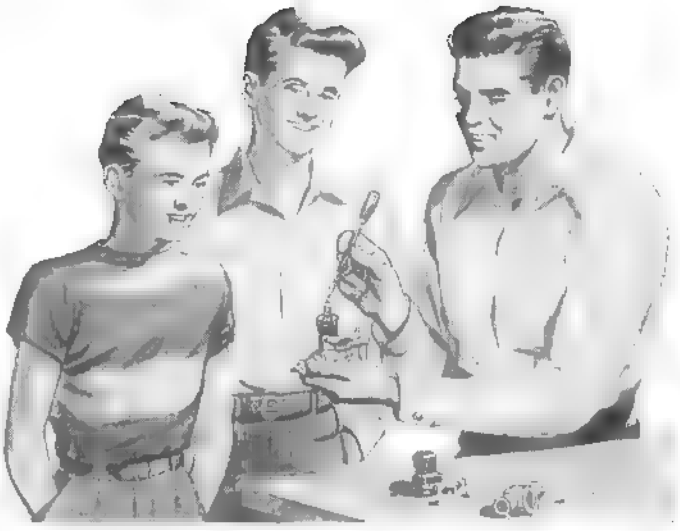
KEY TO PARTS OF MODEL ENGINE

1. Offset spark plug	11. Exhaust stack
2. Piston baffle	12. Fuel line
3. Piston rings	13. Intake tube
4. Piston	14. Needle valve
5. Wrist pin	15. Rotary valve
6. Intake by-pass	16. Gasket
7. Connecting rod	17. Mounting lugs
8. Timer	18. Timer points
9. Ball bearings	19. Cam
10. Cylinder liner	20. Crankshaft



1 PRINCIPAL PARTS OF A TYPICAL MODEL GASOLINE ENGINE

ENGINE



One of the quickest ways to appraise an engine is to study the crankshaft. If it is carefully machined from high-grade material, it is an excellent shaft, provided the cross-sectional sizes are sufficiently large to prevent distortion or whipping at high speeds. Manufacturers of two-cycle engines designed for installation in model speed planes, where space and weight are extremely limited, quite generally use the composite counterweighted crankshaft shown in Fig. 1. Properly machined and balanced, this type of shaft will attain extremely high speeds without distortion or damaging vibration. Ball bearings are used on parts that are designed to operate at high speeds, but for crankshafts, which rotate at comparatively slow speeds, oil-impregnated bushings are adequate. Take a good look at the crankshaft bearing. The longer it is the better. However, if the bearing is made of bronze and is not the self-oiling type, which requires no supplementary lubrication, it should have lubrication grooves to prevent seizing.

Note the needle valve and valve body of the carburetor. They should be made of the same material so that their coefficients of linear expansion will be identical. Brass often is used for these parts as aluminum is too soft for this purpose. The needle valve should have a very fine thread to obtain minute adjustments of the mixture. Gas-resistant, transparent-plastic fuel lines are an advantage due to the fact that a clogged fuel line can be detected immediately, as the flow stoppage is apparent.

Ordinary paper, cardboard or cloth does not provide satisfactory engine gaskets. They should be cut from special gasket material that is both heat resistant and strong, and sealed in place with pure orange shellac, for best engine performance.

Darts Whittled From Wooden Shingles Are Thrown Long Distances

These high-flying darts can be made by any child old enough to use a knife for whittling, and after a little practice, they are easily thrown a surprisingly long way. The darts are shaped from a wooden shingle, as indicated. The thin end becomes the tail, this portion of the shingle being about 2 in. wide. Then a notch is cut about 1 in. from the butt end of the shingle. A piece of string approximately 2 ft. long is tied to a handle and a large knot is made at the end of the string. Fishline or strong twine is best for this purpose, while any stick or tree branch that will not break readily provides a suitable handle. To launch the dart, place the string in the notch and pull tight against the knot. Hold the tail of the dart in one hand, the handle in the other, and keeping the string taut, release the dart as the handle is whipped forward and upward.—M. K. Voedisch, Rockford, Ill.

"Nursing" Your

How to use and care for an outboard motor to give it long life

By C. E. Packer

WITH many outboard motor parts no longer available, unnecessary wear or damage to these little power plants becomes more than a personal inconvenience. Many of the actions most harmful to a motor often seem innocent enough. For example, a person who is most careful with his motor when carrying it in a car, may stand it on the tank and flywheel to be sure that it is held firmly as in Fig. 3. In this position, any water in the lower housing is likely to drain into the cylinder where it may cause serious damage. Sometimes you see a motor stored in a boat as in Fig. 2. The power unit being lower than the propeller in this position, is in danger of cylinder rust, piston corrosion, and wrist-pin injury. Of course, padding the engine or tying it securely to prevent bouncing around is essential, but keep the power unit higher than the propeller end.

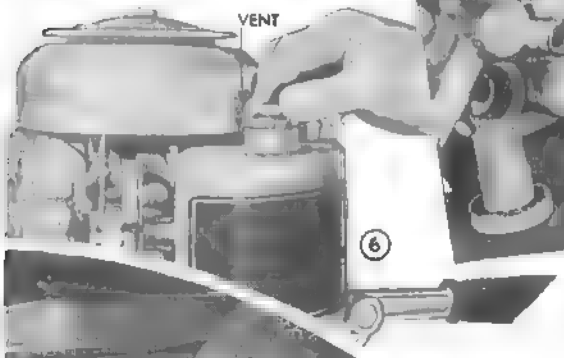
One of the greatest single causes of trouble with an outboard motor is carelessness in mixing the fuel and oil. Even those who know better frequently trust to luck that vibration will

TWO DON'TS ON MOTOR "POSTURE"

Outboard

④ KEEP GAS LINE CLEAN

blend the oil and the gasoline. If the gasoline and oil are not mixed thoroughly, gasoline alone may enter the motor and cause extremely rapid wear. Oil alone will make starting impossible. Therefore, it is best to mix the fuel in a clean container, such as the special outboard fuel can seen in Fig. 1. The small passages through which the fuel must travel are seen in Fig. 4. As the tiny strainer screen shown on the pencil in this photograph handles the fuel and oil for a 5-hp. motor, it is apparent that a few tablespoonfuls of either oil or gasoline entering through the gas lines or carburetor bowl without being properly mixed may cause serious results. As a safety precaution, the drain plug and screen should be removed after every 10 to 20 hrs. of operation and cleaned of any moisture or other foreign matter. If starting has been difficult, it is a good idea to remove the other screws seen in Fig. 5 from the lowest parts of the carburetor and pour a pint of clean gasoline through the tank, being sure to shake all of it out before putting the screws back in place. When a motor starts easily, runs satisfactorily for a few moments, and then stops, faulty gasoline flow usually is indicated. This may be due to failure to open the gas tank air vent, Fig. 6, or it may be due to an obstruction in the bottom of the gas tank, or in the gas line.



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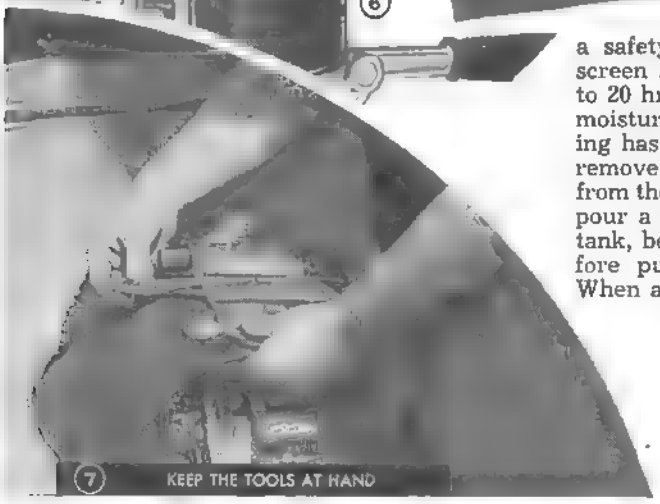


⑦ KEEP THE TOOLS AT HAND

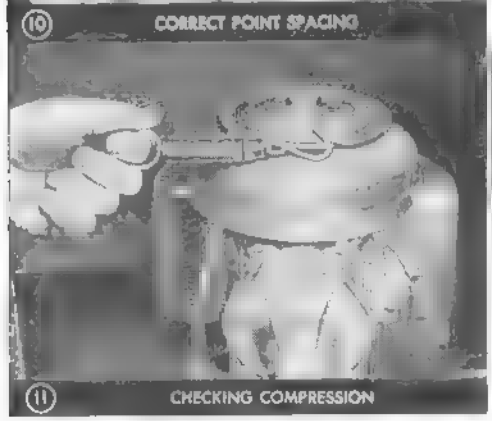
Another thing to remember is

Hints on how to use outboard motors

8 FORCING PLUGS STRIPS THREADS

9 GRAPHITE ON PLUG THREADS

10 CORRECT POINT SPACING

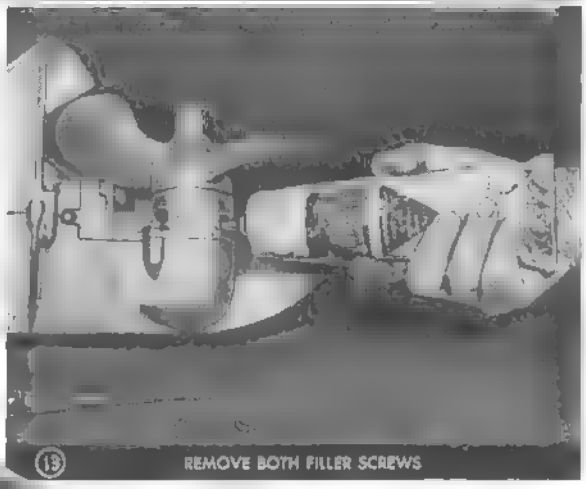


11 CHECKING COMPRESSION

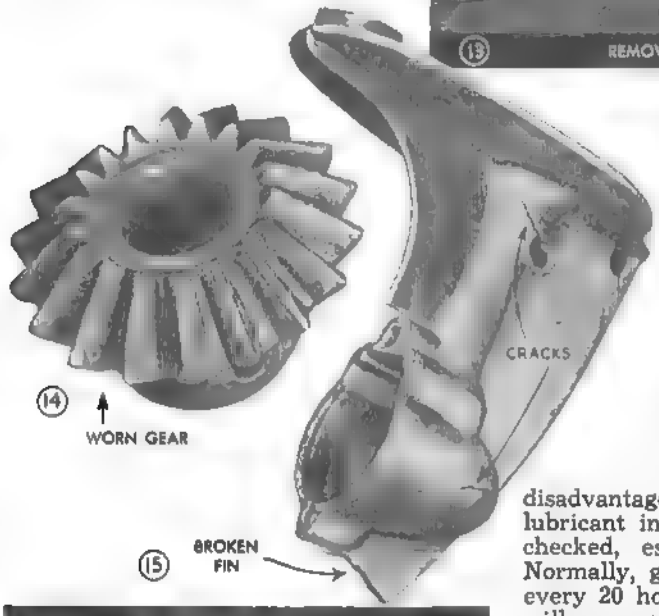
always to have the outboard tool kit aboard when under way, Fig. 7. Extensive damage to the motor often results when odds and ends of tools are resorted to in making repairs. Using pliers on the soft aluminum fittings of the motor may damage these parts so that they are useless. And, resorting to too large a wrench, Fig. 8, when installing spark plugs may strip the threads in the cylinder head. Perhaps the best protection against injury to the threads is to apply powdered graphite to the plugs before putting them in place, Fig. 9. This keeps the threads from seizing and makes the plugs screw in easily. Whenever replacing plugs, new gaskets should be used if available, and the plugs should be pulled down just tight enough so that the gaskets are noticeably compressed though not crushed. Failure to pull the plugs tight may cause them to burn. This results from gas escaping around them and raising the temperature above that for which the plugs were originally designed. In addition to this, there is a reduced transfer of heat from the plugs to the water jacket of the cylinder head. This combination teamed up in a high-speed motor can cause total plug failure in a short time. Of course, many motors are used at a lower rate of speed than formerly, trolling by the hour where permitted. Consequently, the selection of proper plugs introduces a new problem. One motor manufacturer advocates reducing the amount of oil in the fuel when the motor is used for trolling, which brings up the problem that one may troll for a period and then, finding results unsatisfactory, "give 'er the gun" and run over to another portion of the lake. Naturally if the fuel is low in oil content, heating and wear may result. For this reason, operators

12 MOTOR ANGLE ADJUSTED

who know exactly how and where they intend to fish invariably reduce the oil content for long periods of trolling and keep their high-speed fuel and their trolling fuel in separate well-labeled cans. Then, on a run of 15 to 20 min. out to the fishing grounds, they will dump in just enough gasoline of high oil content to make the fast run, after which the tank is filled with gas of low oil content for trolling. However, it is a good idea to carry a few extra plugs. If a plug has an insulator that is



(13) REMOVE BOTH FILLER SCREWS



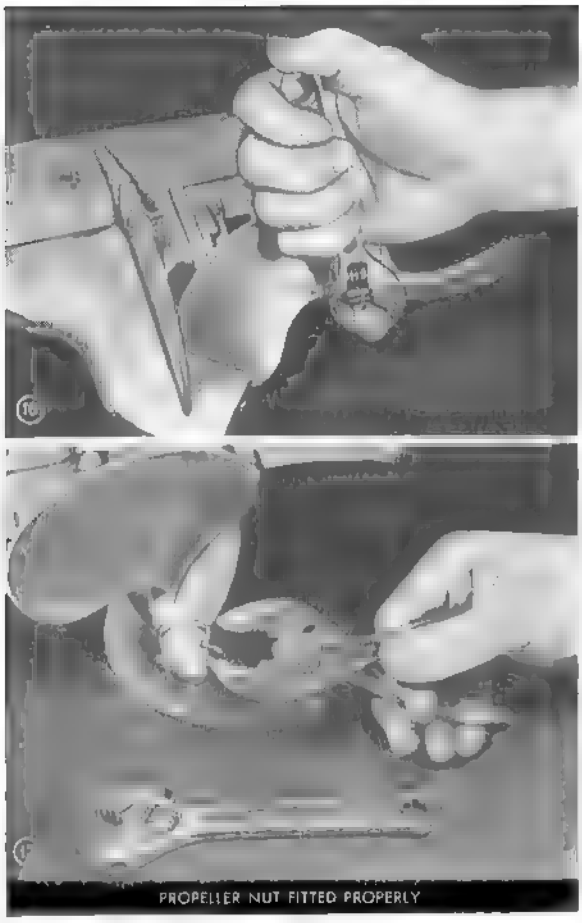
PROTECT THE DRIVE SHAFT

burned pure white, the plug is too "hot" for that particular motor or condition of operation.

Motors that operate satisfactorily at high speed may not run continuously and smoothly at low speed, due to slightly uneven compression. But for best results in any motor, absolutely uniform plug gaps set with a wire-type feeler gauge as in Fig. 10 will help. While the experienced operator learns to "feel" the compression of his motor by grasping the flywheel and turning it, still some operators measure the resistance by using their fish-weighing scale as in Fig. 11. In order to make comparable tests the motor should be warm and the oil mixture in the fuel should be the same at each test period. On an alternate firing motor it is not necessary to remove a spark plug when making this test, though on a simultaneous firing (opposed) motor plugs of cylinders not being tested should be removed.

When operating a motor on different boats be sure that the drive shaft is vertical, or stands at right angles to the water when the boat is loaded. Failure to adjust the brackets seen in Fig. 12 may place the motor at a decided disadvantage in performance. Also, the lubricant in the gear housing should be checked, especially in smaller motors. Normally, grease should be added about every 20 hours of operation, though this will vary greatly in different motors depending on the tightness of the housing. When checking the unit, both upper and lower filler screws in Fig. 13 should be removed so that the housing will not be airbound. If there is any sign of water it should be removed and replaced by clean grease.

Perhaps the most common form of serious mechanical damage is caused by boulders or logs striking the underwater parts of the motor. Fig. 15 shows a gear housing from which the fin has been broken and in which two serious cracks have been caused by striking a submerged object at high speed. Even though the housing does not break as this one did, the drive shaft may be sprung enough to cause serious gear wear, as indicated by the gear in Fig.

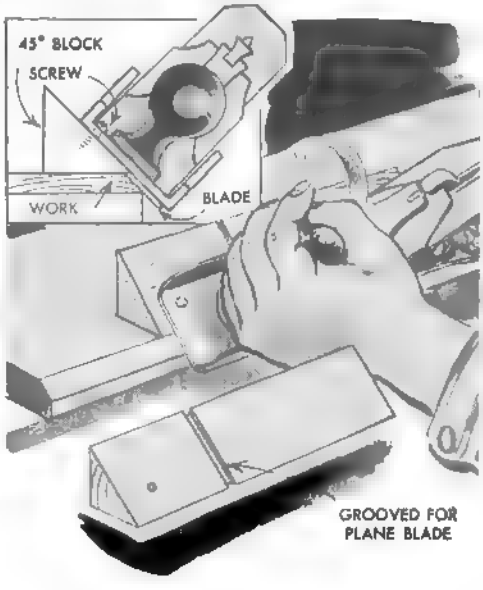


14. If shear pins in the propeller persistently "let go" without the propeller apparently striking any object it is an indication that the flywheel is loose on the crankshaft and is imparting a violent rapping action to the propeller. When replacing shear pins it is important to pull the propeller nut up firmly, Fig. 16, yet not tight enough to strip the threads. The cotter pin used to lock the nut should be clipped off short and bent down as in Fig. 17. Any accumulation of seaweed on the lower housing or other obstruction to the flow of cooling water may burn up the motor. Due to failure of the water pump and lack of observation by the user, the motor may become overheated to the point where it loses power and stops. If this happens never turn the motor on end and let water run into the cylinders while they are extremely hot, and don't start the motor so that it will pump cold water into the hot cylinders. Instead let the engine cool off for about 30 minutes.

Engines operated in salt water should always be rinsed by running them in a barrel of fresh water before putting them away. Failure to do this may result in the complete eating out of all aluminum parts making expensive repairs necessary.

Simple Jig Aids in Edge-Beveling Boards With a Hand Plane

Having a number of boards on which the edges had to be beveled at exactly 45 degrees with a hand plane, the job was done with the aid of this jig. Being nothing more than a triangular wood block, the jig is screwed to the plane to cover half the blade as indicated, and thus hold the plane against the work at an angle of exactly 45 degrees. By using this setup, accuracy is assured and the beveling job is no more difficult than a regular edge-planing job.



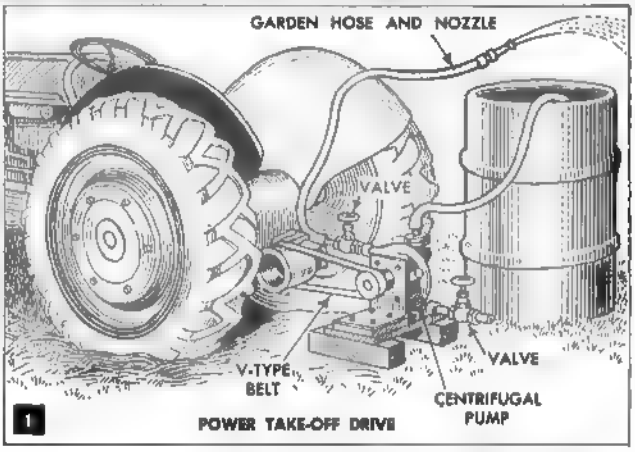
Preserving Leather Book Covers

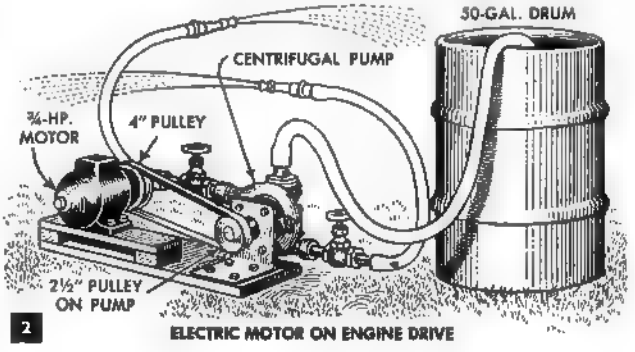
Waxing the covers of leather bound books about once a year preserves them in much better condition. The treatment also benefits chairs, luggage and numerous other leather articles. Cover all but the parts to be waxed and apply a thin coating of liquid or paste wax. Let this dry slightly before polishing with a soft, clean cloth or lamb's-wool mitt. A small shoe buffer also makes a good polisher.

CATTLE SPRAYER IS POWER DRIVEN

RANGE cattlemen and dairymen will find this simple cattle sprayer easy to build from parts which are readily obtainable at a cost of about $25, less the engine or electric motor. Some operators belt the sprayer directly to a tractor as shown in Fig. 1, while others drive it as in Fig. 2. Ordinary garden hose and nozzles will serve for handling the solutions commonly used to control such insect pests and parasites as lice, horn flies and ticks. To control horn flies and lice use a solution of 3½ lbs. of 50 percent wettable DDT powder mixed with 100 gal. of water. For control of ticks use a solution of 7 to 8 lbs. of 50 percent wettable DDT powder to each 100 gal. of water. Dissolve the powder in a small quantity of water, then add the full amount later.

C. A. Stone, Bastrop, Tex.

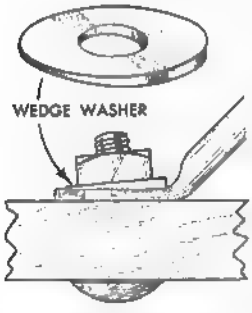




Speedy and Thorough Tool Oiling With This Handy Oiler

To speed up the job of oiling hand tools and, at the same time, make the job less disagreeable, one carpenter carries a handy oiler made from a length of 1-in. tubing or pipe and oiled cotton waste. The tube is packed with oiled waste, and in use, a portion of the waste is pressed out the end of the tube as shown.

Wedge Washer Locks Nut on Bolt

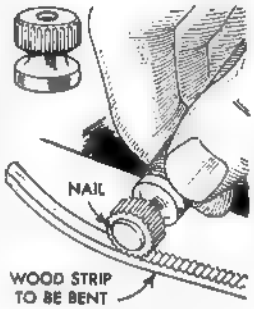


When using a bolt where vibration is likely to loosen the nut and there are no lock washers at hand, make a wedge washer by tapering an ordinary flat washer along one side. When a nut is driven down on the tapered washer, the bolt is twisted slightly to one side so that the threads will hold securely.

Old Clocks Fitted With New Faces By Photographic Process

The difficulty of obtaining new faces for old clocks and the high cost charged by commercial artists to paint special ones, led one jeweler to use his photographic equipment to solve the problem. This was done by removing the hands from a new clock so that a close-up photograph could be taken of the face, after which the negative thus obtained was used to make enlargements of any size desired on photographic paper of heavy weight. Only a few minutes are required to fit and glue these new clock faces onto old ones.

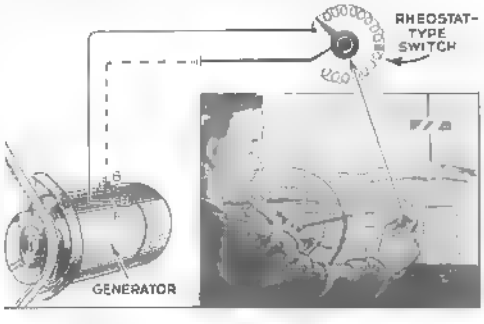
Tiny Wood Strips Bent Easily Without Steaming

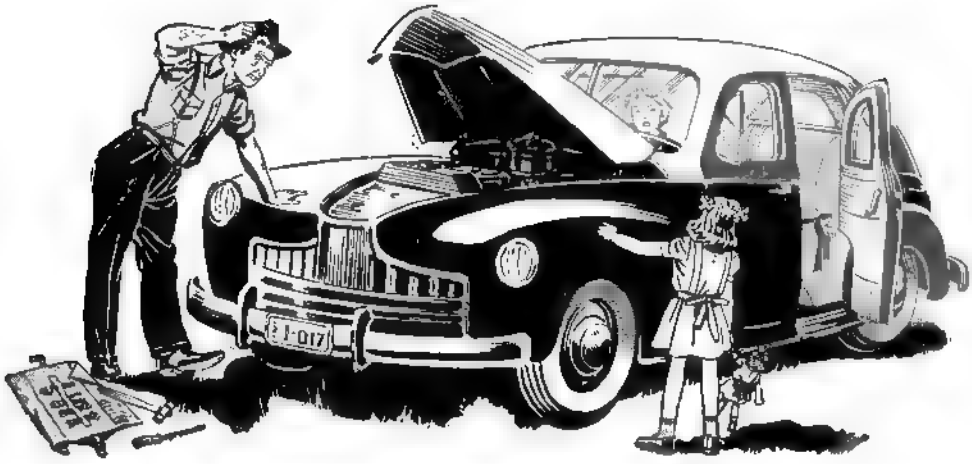


Thin wood strips used in the construction of tiny models often can be bent without steaming if they are scored as shown with a roller wheel made from a binding-post nut such as those used on small dry cells. The nut should be slipped over a nail driven into a wooden handle for easy operation.

Output of Generator Controlled By Heater-Switch Circuit

If a car is used on short runs where frequent stops are made, voltage and current regulators sometimes reduce the charging rate of the generator too soon. To prevent this and keep the battery more fully charged, a rheostat-type heater switch to control the charging rate manually can be connected to the generator field terminal as shown in the wiring diagram. As most generator field circuits are completed by grounding the field terminal, the switch circuit should be from the field terminal, terminal F in the diagram, to the ground. However, as some generators complete the circuit by connecting the field terminal to the main terminal of the generator, terminal B, it may be necessary to complete the switch circuit by wiring the switch to both generator terminals as indicated by the dotted line. Turning the switch to the "on" position will give maximum output; a setting somewhere between "on" and "off" will give a reduced output.





Getting Home on a Sick Engine

If your car suddenly goes dead on the road, simple checks may enable you to locate and repair the trouble, at least temporarily so that you can get to a garage

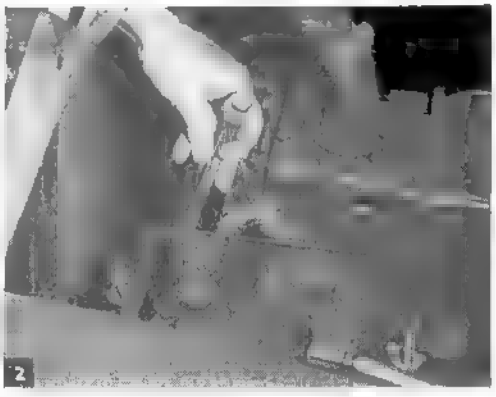
IF YOU have ever had your car engine conk out on the road and experienced a helpless feeling as the car coasted to a stop miles from a garage, this article will be helpful. No doubt, your first thoughts were of an expensive service call, or even a stiff tow bill.

In many cases you can locate the trouble right on the spot and either correct it, or at least make a temporary repair that will permit the car to be driven home or to the nearest garage where permanent repairs can be made, thus saving the delay and expense of a service call or tow charge, especially on holidays when repair shops are closed.

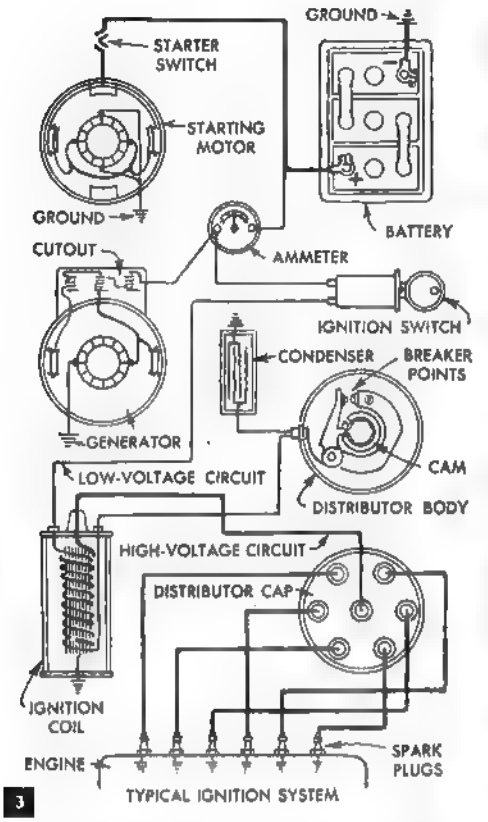
Naturally, insurance against engine trouble on the road is to inspect the engine at regular intervals, make necessary adjustments and keep worn parts replaced. Also, it is a good idea always to carry a small emergency kit consisting of a few simple tools, such as wrenches, spare insulated wire, friction tape, a quart bottle and a 3-ft. length of small hose for siphoning gas from the tank.

But if you do get stuck on the road, just remember that a car engine needs four things to make it operate; fuel in the carburetor, spark at the spark plugs to ignite the fuel, and oil and water to prevent wear

Holding spark-plug cable ⅛ in. from cylinder head should produce a hot spark as engine is turned over



Clean and tighten cable connections at battery periodically. See that the ground connection is tight



When you remove distributor cap, inspect for cracks

Check all wiring in the distributor whenever it is opened and make sure the condenser ground is tight

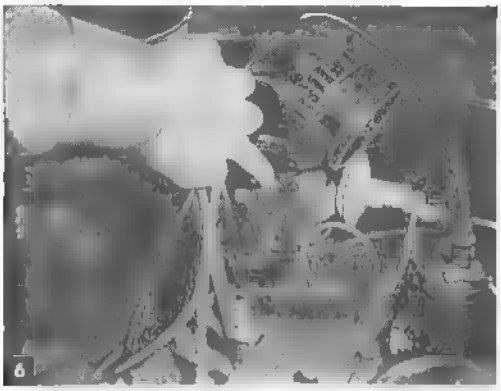
and overheating. A glance at the temperature gauge will take care of the latter two. If the reading is normal, your water is okay, and the chances are the oil is too, because lack of oil would cause the engine to heat. This leaves the fuel and ignition systems, but a process of elimination may enable you to locate the trouble quickly. Just how the engine "died" may give you the key to which system is at fault. If the engine gave no signs of starting as the car coasted, the ignition system may be suspected. Sputtering, grabbing and kicking in and out is likely to indicate that the fuel system is at fault. In any case, check the fuel supply in the tank first.

If you suspect the ignition system, start the process of elimination by trying the starter. If it works, the battery and cables are all right, but don't overlook the possibility of loose connections at each end of the battery cables, or a broken cable. Sometimes they loosen and vibration will break the circuit enough to stop the engine, which may operate when the car is standing. Tighten the cables, Fig. 2. If one is broken, twist a few strands of heavy wire together, even fencing wire, for ■ repair.

If this does not locate the trouble, and still assuming that the starter works, go back to the ignition. Remove the distributor cap and inspect it for cracks, Fig. 4. Then turn on the ignition switch and crank the motor until the distributor breaker points close. Now, with the switch on, spread the points quickly with your fingers. This should produce a spark. If it does, the ignition is okay to the distributor. Next, remove one of the spark-plug wires and hold it about ⅛ in. from a cylinder-head bolt, Fig. 1, and crank the motor over a few times. You should see a spark jump from the end of the wire to the bolt. If it does, the entire ignition system is okay.

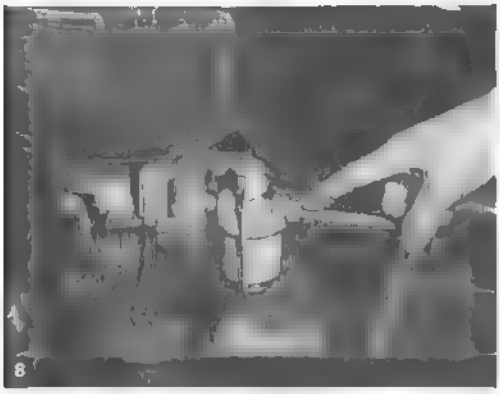
The next move is to check the fuel system. Disconnect the fuel line at the carburetor or at the discharge side of the fuel pump and crank the motor several times. Gas should flow from the pump. If these few preliminary checks, which are fairly easy to do, have not disclosed the trouble, they should enable you to determine which system is at fault. It is now a matter of tracing the trouble to its source.

Suppose you found that the fuel system caused the trouble and gas did not flow



Breaks and abrasions in wiring, or loose connections inside distributor, may short-circuit the ignition coil

Hold coil-to-distributor lead ¼ in. from the cylinder block. If the coil is okay there will be a hot spark

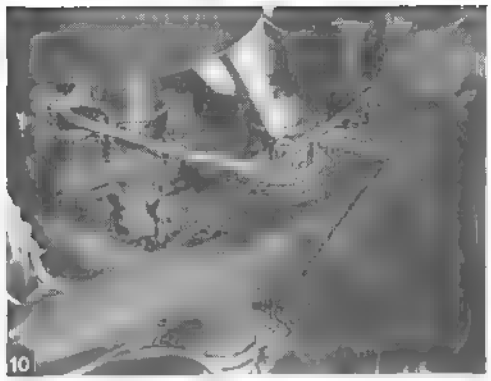


The fuel filter should be cleaned periodically. Wash out sediment and be sure screen is clean and open

Examine flexible line on the suction side of the fuel pump closely. Breaks here often cause air leaks

from the line when it was disconnected. The trouble is most likely to be in the fuel pump or the flexible connection between the main fuel line and the pump. However, check the filter screen in the line. The screen may be located as in Fig. 8, or it may be at the pump or carburetor. Usually a clogged screen does not stop the motor dead without long warning several days ahead. Again connect the fuel line to the carburetor, remove the air cleaner from the carburetor and pour a tiny stream of gas into the air intake while cranking the motor with the switch on. A pop bottle is best for pouring the gas. If there isn't a small hose for siphoning the gas from the car tank, there is a drain plug in the bottom of the tank that can be taken out to get gas. Be careful, though, in doing this or you will be sprayed with gas. Race the motor for several seconds. Sometimes this procedure will start a defective fuel pump to working. If it does, don't stop the motor because the pump may refuse to work again. If the motor refuses to start, check the flexible connection between the pump and main gas line, Fig 9. It may be cracked either externally or internally, allowing the pump to suck air into the line. Wrap it tightly with tape and again try the above procedure. If this fails, disconnect the fuel line at the pump, remove the fuel-tank cap and blow into the tank, pressing your cheeks tightly over the filler hole to prevent air from escaping. By this means, you can build up enough pressure to force gas from the line at the pump if the line is not clogged. If it is clogged, try to blow it out with a tire pump. If all of these remedies fail to correct fuel-system trouble, a mechanic is about your only hope.

If, however, the difficulty was found to be in the ignition system, it's a matter of eliminating the most likely causes of the trouble progressively. Fig. 3 shows the circuit of a typical ignition system. Suppose, for example, you had a spark at the distributor breaker points, but none at the plugs. The trouble is probably a damaged rotor. The spring contact may be broken or worn so that it does not touch the center contact in the cap. Sometimes a temporary repair can be made by binding a piece of tin or other thin metal to the rotor to carry



To check operation of the fuel pump disconnect the line on discharge side and turn the engine over

current from the center contact through the rotor. Don't overlook the possibility of a loose ground on the condenser, Fig. 5, which should be tightened.

The final check for this part of the ignition system is to remove the high-tension wire from the center contact of the distributor cap and make sure that it is clean and is seating correctly in the cap well, and also that it is not broken. Hold the free end about ¼ in. from the cylinder head as in Fig. 1, and crank the motor over several times. You should get a fat spark from the wire to the head. If not, the coil may be at fault.

To make sure about the coil, remove the "hot" primary wire from it and rub the end against an unpainted metal part of the car. There should be some indication of sparking. If there is sparking, and the connections in the distributor are tight and in good condition, Fig. 6, the trouble is likely a dead coil, which will have to be replaced. If you did not get sparking at the end of the primary wire, the trouble is between the coil and the battery. Trace the circuit, tightening all connections as you progress. Likely you will find a loose connection or a broken wire, but don't overlook the possibility of trouble in the ignition switch. Be sure the ignition switch is on when making the tests on the ignition.

In making periodic checks to avoid engine failure, consider the following:

(Approx. intervals: M—monthly, T—twice a year, Y—yearly)

IGNITION SYSTEM

Spark Plugs

1. Clean, inside and outside ..... T
2. Look for cracks in the porcelain ..... T
3. Adjust points to recommended setting..... T

Distributor

1. Clean inside and outside ..... T
2. Clean terminal sockets in cap and metal contacts on wire ends ..... T
3. Inspect for cracks in cap and body ..... T
4. Adjust breaker-point gap. Replace points if necessary ..... T
5. Replace frayed or swollen wiring ..... T
6. Test condenser and tighten connections..... Y
7. Oil drive shaft and wick under rotor. Wipe trace of petrolatum on cam face ..... M
8. Check breaker spring tension and condition of fiber bumper on breaker arm ..... T
9. Inspect rotor contacts for burning or wear. Also, inspect metal inserts which distribute current to spark-plug wires ..... T
10. Have timing and various timing controls checked ..... Y

Coil

1. Clean and tighten connections ..... T
2. Test for condition ..... Y

Battery

1. Clean surface. Grease terminals ..... M
2. Clean and inspect ground strap and starter lead ..... T
3. Check gravity and water level ..... M

Instrument Panel and Wiring

1. See that all gauges work properly ..... M
2. Check wiring under dash for loose connections and frayed or broken insulation ..... T

FUEL SYSTEM

Tank

1. Clean vent ..... M
2. Drain and clean ..... Y

Pump and Filter

1. Drain filter and renew gasket ..... M
2. Check pump delivery ..... T

Carburetor

1. Have cleaned and adjusted ..... Y
2. Check choke action ..... T
3. Check manifold heater ..... T
4. Lubricate controls ..... M

Fuel Lines

1. Check for kinks and air leaks and tighten all connections ..... T
2. Especially check any flexible connections on suction side of pump ..... T

Air Cleaner

1. Clean element ..... M
2. Drain and refill oil type ..... T

COOLING SYSTEM

Radiator

1. Flush complete cooling system and protect with antifreeze and antirust ..... T
2. Repair leaks and clean outer surface of core and grille ..... T
3. Check thermostat ..... T
4. Replace hose connections, including heater leads ..... T

Water Pump and Fan

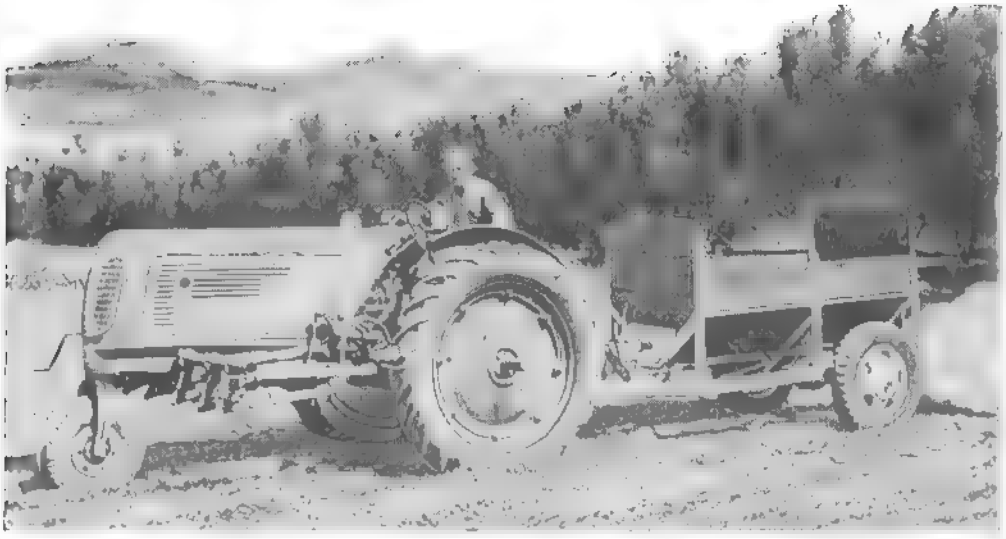
1. Grease both (if required) ..... M
2. Check for leaks ..... T
3. Check fan-belt condition and tension..... T

MISCELLANEOUS

Crankcase

1. Drain, flush and refill ..... T
2. Use seasonal grade of oil ..... T
3. Replace oil-filter element (if any) ..... T

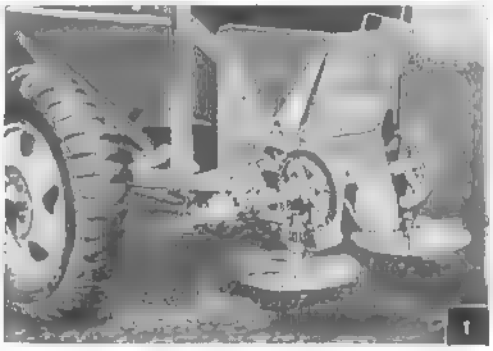
SPREADER for DRY FERTILIZER

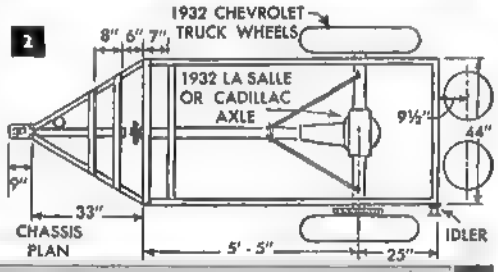


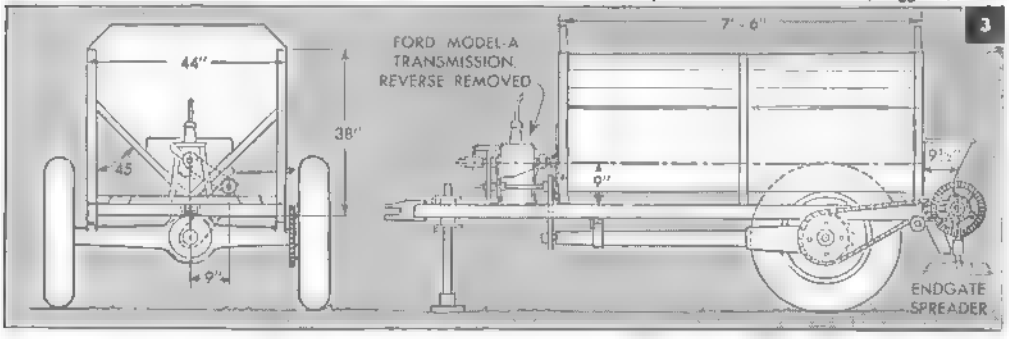
By Hi Sibley

BUILT by Viking Ramsing of Nuevo, Calif., and assembled from discarded automobile and farm-implement parts, this labor-saving spreader enables one man to apply gypsum, lime, sulphate of ammonia and other concentrated plant foods quickly and evenly at tractor speeds. It consists of a hopper of 2-ton capacity mounted on a heavy two-wheel trailer. A 5-in. materials auger in the bottom of the hopper, Fig. 4, carries the contents to an endgate-type distributor or spreader which is mounted on the rear of the trailer frame and ground-driven from one of the trailer wheels. The hopper screw is chain-driven from the trailer axle through an auto transmission from which the reverse gear has been removed. The whole thing can be towed by any small tractor and is easily maneuvered on its two wheels.

The transmission is taken from a Model-A Ford, the axle from a 1932 Cadillac and







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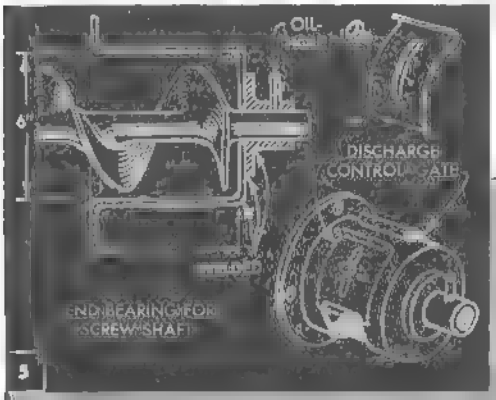

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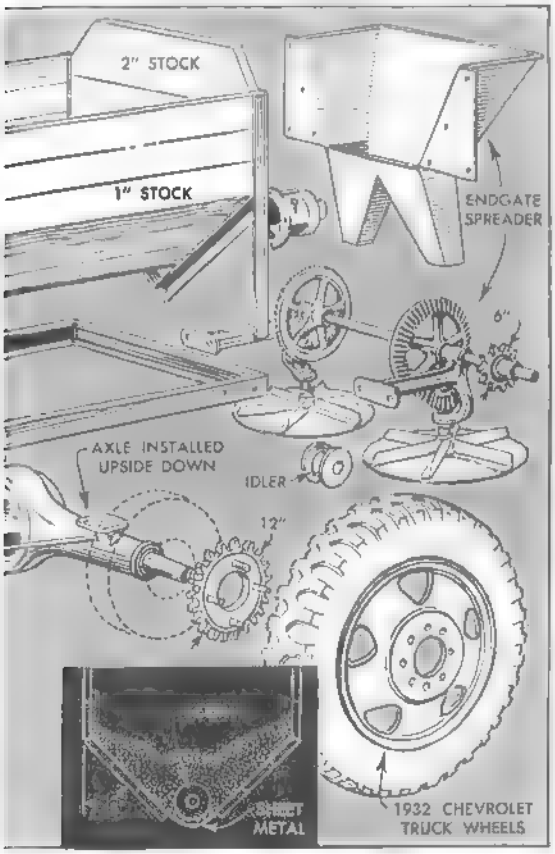
the wheels from a 1932 Chevrolet truck. The endgate distributor, Fig. 1, is a standard unit. A plan view of the chassis is shown in Fig. 2, while front and side views are shown in Fig. 3. The jack at the forward end, Figs. 3 and 7, is made from two pieces of pipe, the sliding member or leg being cut from 1½-in. pipe. This telescopes into a sleeve of 2-in. pipe welded to the drawbar. Holes are drilled in the two members to take adjusting pins, Fig. 7. Side members of the frame are 3-in. steel channels strengthened by angle-iron cross braces, or spreaders. The legs of both channels are notched at a point near the forward ends and the channels are bent inward, the ends being welded to a length of 3-in. pipe to form the drawbar. Dimensions are not given on these parts as size must be determined during assembly.

Note that the frame for the wooden hopper is made from angle iron, with a channel formed in the upright angle at each corner by welding in a strip of flat iron as in the upper detail in Fig. 6. Ends of the wooden sideboards fit loosely in these channels. In order to drive the auger in a counterclockwise direction through the transmission, the Cadillac rear axle is in-

6

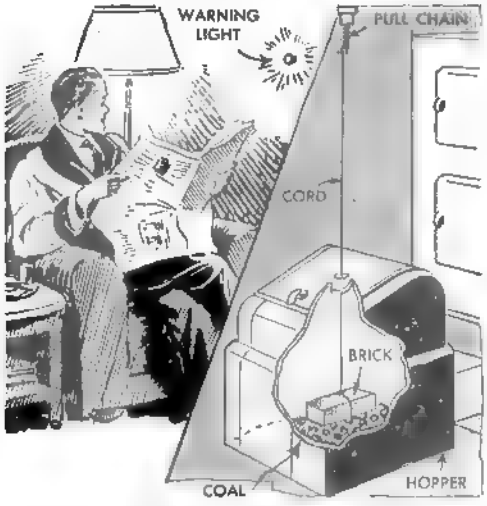
stalled upside down, the spring seats being welded or bolted to the trailer frame. A U-shaped strap welded to an angle-iron cross brace of the frame supports the drive-shaft housing, Fig. 6. A 4-in. drive sprocket is fitted on the end of the drive shaft. This drives a countershaft which, in turn, drives the transmission. The drive assembly is shown in the lower left-hand detail, Fig. 6. The bracket and support arrangement shown in Fig. 6 must be fitted to the transmission at the time of assembly.

The hopper bottom boards are set at a 45-deg. angle with the sides and are covered with sheet metal. Rear end of the auger carries the hopper contents into a cylinder or distributor head, made from 6-in. pipe to which a flange is welded as in Fig. 5. Holes are drilled in this flange so that it may be bolted to a triangular-shaped steel plate which, in turn, is bolted to the end of the V-section of the hopper in the same manner as a similar plate is attached to the opposite end of the hopper back of the transmission. Flanged bearings attached to the plate at the front of the hopper and to the back of the distributor head carry the auger shaft. Square openings are cut in the distributor head, Fig. 5,



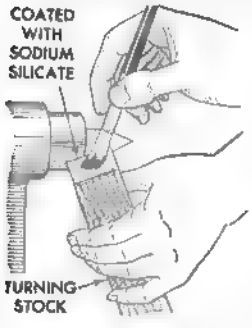
and adjustable sheet-metal gates fitted over these openings control the amount of material fed to the spreader hopper. The adjustment of these gates provides for feeding various materials to the spreader in sufficient amounts to maintain a uniform rate of spreading. Usually, the spreader unit is provided with an adjustable gate with which settings can be made by means of a scale and pointer to distribute varying quantities of material per acre. The three-speed auto transmission permits changing the speed of the auger. This provision, in addition to the control gates in the distributor head and the variable-gate settings in the spreader, gives a range of adjustment which makes it possible to spread almost any quantity of fertilizer per acre. The drive chain for the spreader is carried over an idler mounted on the rear of the frame, Fig. 3. Although the drive sprocket is shown mounted inside the trailer wheel, some users will prefer to have it mounted outside the wheel so that the chain can be removed when the trailer is to be used for other purposes or hauled idle for long distances. With minor changes in dimensions, other auto parts can be substituted for those specified. However, the ones specified were found to be best suited for the purpose. When the unit is to be stored, oil all metal parts to prevent corrosion.

Light Warns When Coal Gets Low in the Stoker Hopper



If you sometimes forget to fill the hopper of your automatic stoker, a light located in a conspicuous place in the house and controlled as shown will serve as a warning to fill the hopper. A pull-chain switch is located on the basement ceiling directly above the center of the stoker hopper and is wired in the lamp circuit. Then, a brick or other suitable weight is attached to the pull chain of the switch by means of a length of strong cord, which passes through a tiny hole in the cover of the stoker. The cord should be just long enough so that the weight will operate the switch when the fuel level in the hopper reaches a predetermined height. Of course, the brick must be removed and placed on top of the fuel each time the hopper is filled.

Lathe Center Holes in Soft Wood Hardened for Easy Turning



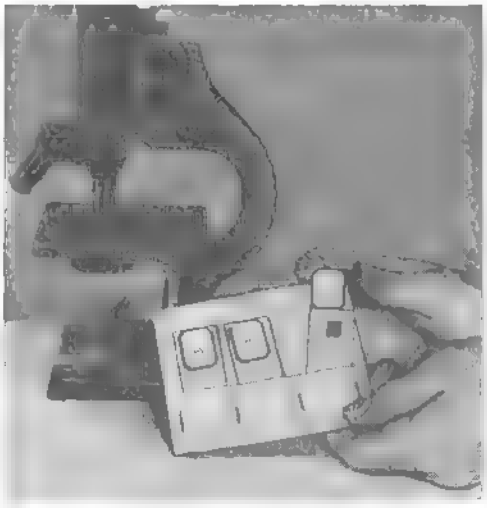
Any tendency of the lathe tailstock center to enlarge the hole in soft wood when turning it so that the work cannot be trued accurately, can be avoided by hardening the wood surface at this point with silicate of soda. After locating the center of the work and before putting it in the lathe for turning, apply the silicate of soda liberally where the lathe center will contact the work. This treatment permits thorough lubrication at the point of contact between the lathe center and the work and allows the latter to be supported snugly between the lathe centers.

Mortar Insulates Stone Building

When building a cabin or cottage of field stone, it is best to avoid the use of any stones that are wide enough to reach across the entire thickness of the wall. Cold penetrates such stones rapidly, depending on their porosity, and makes the building hard to heat. Furthermore, moisture may condense on the inner surface of the wall, and in extreme cold weather may even form ice on the walls. However, if smaller stones are used, making one or more mortar joints necessary across the thickness of the wall for each layer of stone, the mortar, being highly porous, will act as insulation and prevent this condition.

Storing Microscope Slides

Made easily from thin cardboard, the holder shown will help to keep your microscope slides in order and protect them from breakage. To make a holder, use a piece of cardboard 5 in. square. Draw a line

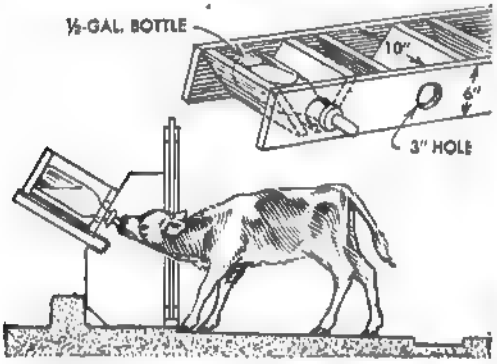


across it 1½ in. from one end and fold it along this line. At 1½-in. intervals, staple the folded cardboard, beginning ¼ in. from one edge. Holders for more slides can be made by adding 1½ in. to the width of the cardboard for each extra pocket.

Bottle Feeder Weans Calves at an Early Age

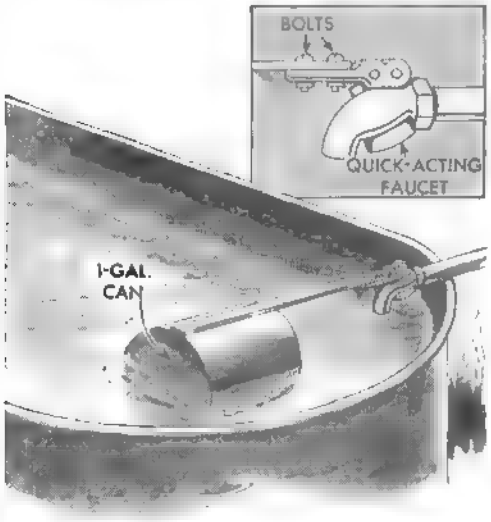
Farmers and dairymen will find this calf weaner a real timesaver. A simple bottle rack, designed to hold either six or twelve ½-gal. bottles, is mounted on the feed-trough side of a row of specially made stanchions, Figs. 1 and 2. When the nursing calves have finished, the bottles are removed from the rack, which then can be lifted off the feed trough. Stanchions are graduated in size from 4 to 5½ in. Baby calves start in the smaller stanchions and are moved to the larger sizes as they grow. In this way calves can be weaned from milk to dry feed in a much shorter time. As shown in Fig. 2, the feed trough is fitted with metal partitions, which are attached to the stanchion frames with bolts.

Above, calf nursing from ½-gal. bottle in same position as it would from mother. Below, front view of stanchions with bottle rack in place. Note partitions



Water Level Maintained in Livestock Tank With Automatic Control

Although use of a float-and-lever mechanism to control flow of water is not new, here's an application of the idea that will automatically keep a watering tank filled at a constant level and save many a trip to the tank to turn the faucet on and off. Principal parts of the mechanism are: A 1-gal. can, flat-iron lever and a quick-acting faucet of the type that opens when the handle is depressed. Seal the can so that it does not leak and solder it to one end of the lever. Then bolt the other end to the faucet handle and test for operation. It may be necessary to shorten or lengthen the lever somewhat to secure proper balance so the weight of the can will open the faucet as the water level drops. After the unit is assembled and operating satisfactorily, paint it to prevent rusting. Although not shown, a guard bolted to the tank, covering the float and faucet, will protect it from damage by livestock.



Herbert E. Fey, New Braunfels, Tex.

Shorten the center tine of a three-tine pitchfork to about 7 in., leaving the outside tines 1 in. longer, dull the points slightly by grinding them round and you will be able to handle bundles of cornstalks almost as easily as bundles of grain.

TWO POWER SANDERS

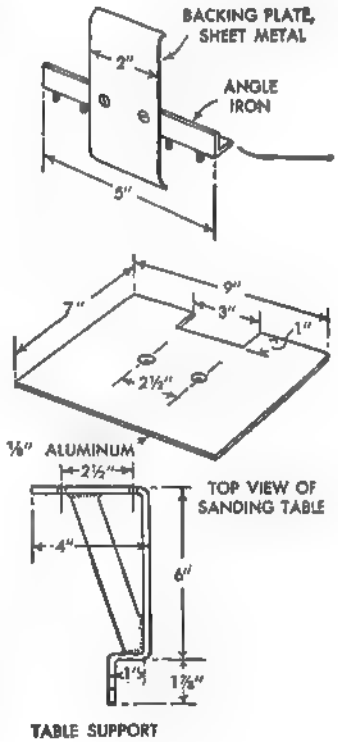
★

One model combines three sanders in one machine driven by a single motor. The other, a 6-in. belt sander, employs standard shaft hangers for bearings, and features positive tension adjustment. Both machines can be built at nominal cost from scrap parts

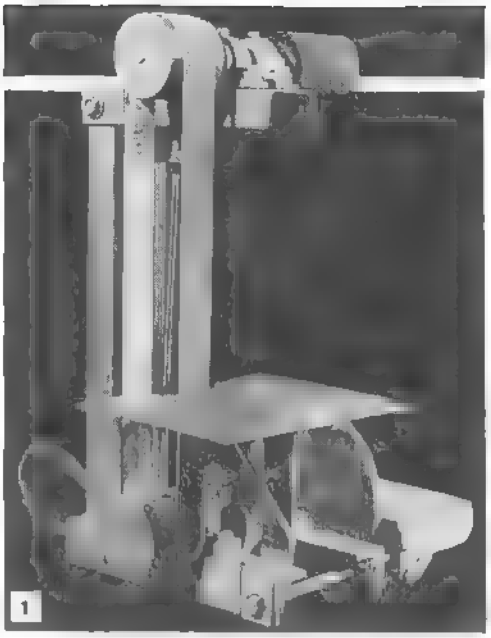
By
R. Barsamian

HERE ARE TWO homemade sanders that will handle practically every sanding job in the home shop. One is a combination band, disk and drum sander, while the other is a conventional 6-in. belt sander. Both can be made inexpensively, using standard parts along with odds and ends.

Band Sander: Figs. 1 and 2 picture and detail the construction of the combination sander. The framework is assembled from pieces of channel iron, the upright being 3-in. channel welded to a 6-in. channel base. Note that the upright is located ▮ in. from one edge of the base and that a 3 by 8-in. opening is cut in the base to permit belting and driving the machine from below. The dimensions given for the frame accommodate a 45-in. standard belt. If a longer one is used, the upright must be lengthened. Holes are drilled in the top surface of the base for mounting two ball-bearing pillow blocks. These carry the drive pulley and double-end shaft which drive the sanding belt and the disk. The arm, which carries the upper bearings, also is a length of 3-in. channel iron with the web cut out at one end, as shown, and the flanges spread apart to fit over the flanges of the channel upright. The arm is drilled and pivoted to the upright with a ½-in. bolt, after first being drilled for two bronze-bushed pillow-block bearings and a tensional rod. In drilling the mounting holes for the pillow blocks, extra care must be taken to assure perfect alignment of both upper and lower bearings. This is important, as there is no provision for adjustment of sanding-belt trackage other than the use of shims under the pillow blocks. It is also important that the holes for the tensional rod in both base and arm be aligned accurately to avoid the necessity of shimming the pillow blocks. The hole for the rod in the arm must be elongated slightly with a round file to provide clearance. The rod, which is threaded at each end, is anchored to the base by two nuts and a lock washer. A washer and nut on the upper end provide a shoulder for the end of a ⅜-in. i.d. compression spring which bears against

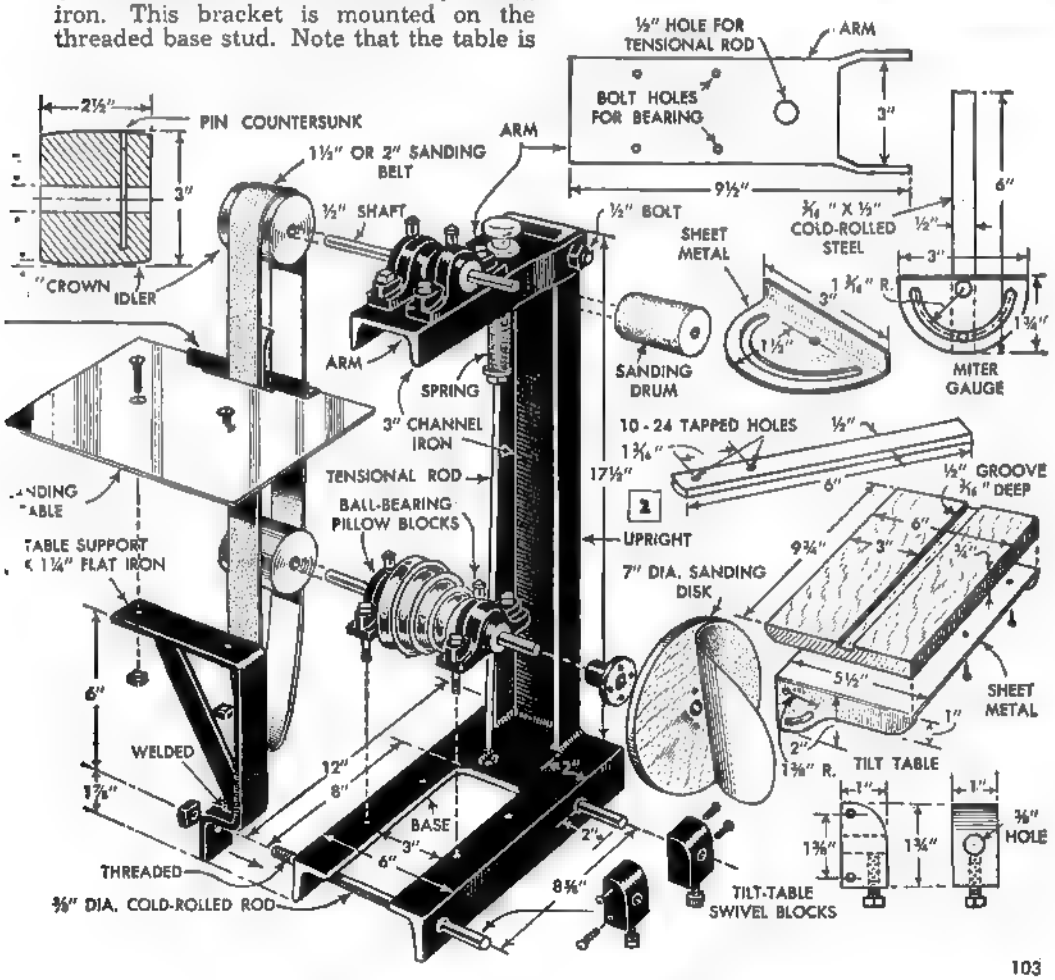


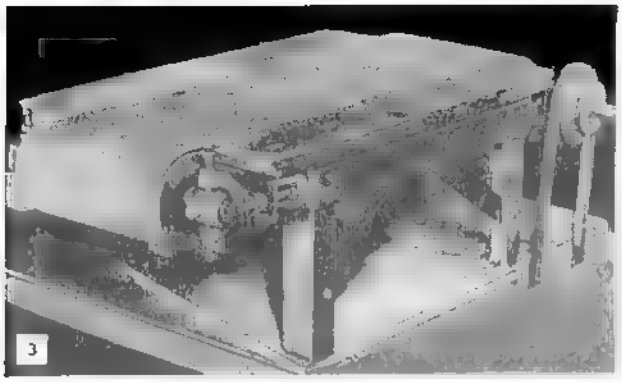
FILL ALL NEEDS



the underside of the arm. The location of the nut and washer must suit the spring used and tension desired. The end of the rod is capped with a handwheel, which is tightened or loosened to regulate belt tension. The flanges of the channel-iron base are drilled for three studs on which the swivel blocks and table bracket are mounted. Two of the studs are formed by a single rod, one end being threaded before tack-welding the rod in position.

The idler and driving drums for the belt sander are turned to size and balanced right on their shafts. This is done by drilling a ½-in. hole in the end grain of hardwood blocks and pinning each block to its shaft with a nail driven crosswise through an undersize hole in both drum and shaft. Note that the drums are crowned 1/16 in. The sanding-belt table, which can be either metal or wood, is supported by a 90-deg. bracket bent and welded from 1¼-in. flat iron. This bracket is mounted on the threaded base stud. Note that the table is



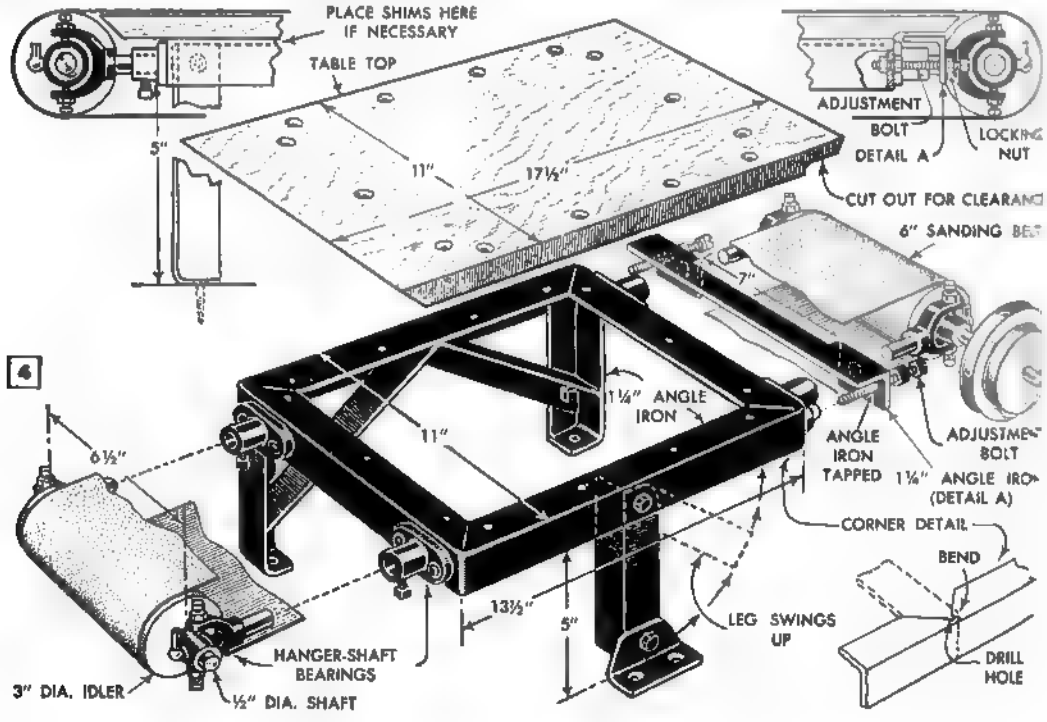


notched at the rear edge to take a backing-plate fixture for the belt. This fixture is installed after the belt is on the drums.

The sanding disk features a tilting table which accommodates a miter gauge. Swivel blocks for the table are cut from 1-in.-square bar stock, drilled to fit over the studs on the base. The top edges of the blocks are rounded to give proper clearance. Note that setscrews are provided to lock the blocks to the studs and that two small machine screws are fitted in tapped holes in the outer faces of the blocks. These screws are for the one-piece trunnion fixture which is bent from sheet metal and faced with a hardwood table, the latter being grooved to take a commercial miter gauge or a homemade one as detailed. The front edge of the wooden table is beveled 45 deg. The sanding disk is a piece of plywood faced with sandpaper and mounted on the shaft by means of a small faceplate. A regular metal sanding disk can be purchased if you wish. Likewise, a commercial unit can be used for the drum on the idler shaft.

Belt Sander: This sander uses standard ½-in. shaft hangers and a 6-in. endless sanding belt. The base parts of the hangers are bolted to the ends of a metal framework that is shaped and braced as shown in Fig. 4. The top part, to which a wooden table is bolted, is bent from one piece of angle iron by drilling a small hole at the point of bend and then cutting out a 90 deg. segment or gusset as indicated in the detail. Welding the mitered corners, as well as the two rear legs, to the frame, makes an exceptionally sturdy assembly. However, the parts can be bolted together. Note that the front leg pivots to permit mounting and removing the sanding belt.

The idler and driving drums are balanced by pinning and turning them on their shafts. Belt tension and tracking adjustment are provided by a piece of angle iron drilled and tapped at each end for a ¼-in. adjusting screw and locknut. This piece

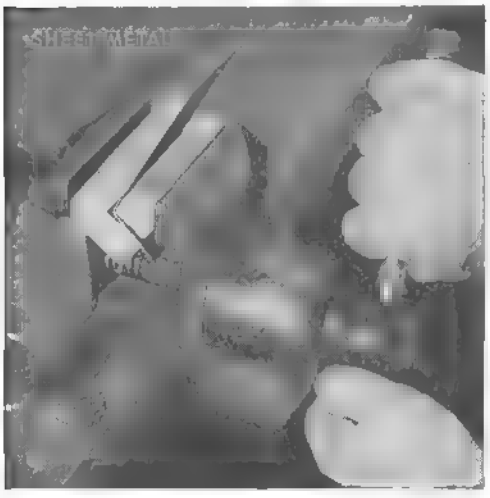


also is drilled at each end to slip loosely over the post of each hanger. It may be necessary to cut out a 7-in. section of the angle iron to give clearance for the driving drum. Belt tension and trackage are maintained simply by turning in or backing out the adjusting screws, as the ends of the screws bear against the frame and force the hangers inward or outward. You may find it necessary to rabbet the underside of the wooden table to provide clearance for the tension fixture. Also, shims may be required between the frame and wooden table to bring the surface flush with the sanding drums. While the sander is shown without a fence in Figs. 3 and 5, one can be made by clamping angle-iron supports to the rear legs of the machine and fastening a hardwood fence to them to overhang and clear the sanding belt.

Note that the pillow-block bearings of the band sander, Fig. 2, and the shaft-hanger bearings of the belt sander, Fig. 4, are fitted with either oil cups or grease fittings. A ¼-hp. motor is sufficient to operate the band sander. However, the belt sander should be driven by a motor of at least ⅓ or ½ hp., especially when coarse sanding belts are used.

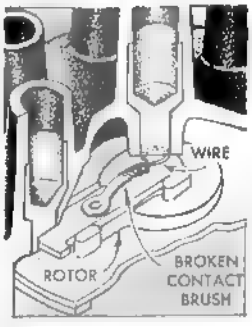
Vise Equipped With Hardwood Die Serves as Sheet-Metal Brake

Sheet metal of light gauge can be formed without marring its surface by using a brake which consists of a block of hardwood cut into two parts so that the pieces come together at the desired angle. The metal is placed between the two parts of the block and a vise is used to force the pieces together. Because of the natural "spring back" tendency of most metals, cut the block apart at an angle greater than the bend required so the metal will be bent slightly more than the desired angle. Also, flatten the corners of the block which rest against the vise jaws to keep the block from slipping when pressure is applied.



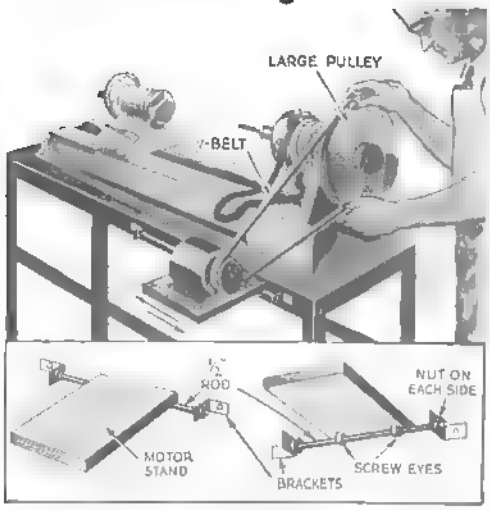
Hairpin Makes Emergency Repair For Broken Rotor Contact Brush

Motorists caught on the road with a broken distributor-rotor brush will profit by remembering this simple emergency repair. It can be made with any bit of wire, even a hairpin, by twisting the wire around the remaining part of the brush and forming the free end of the wire into an eye. The eye is bent upward to make contact with the center terminal of the distributor cap. While this is only a temporary repair, it will permit driving to a garage.



John Krill, Youngstown, Ohio.

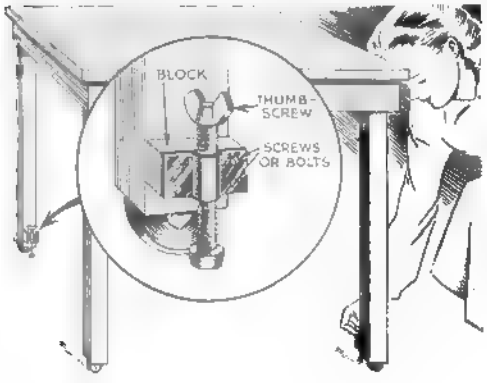
Reducing Speed of Wood Lathe To Use It for Drilling



The problem of reducing the speed of a wood-turning lathe to use it for drilling was solved by one home-workshop owner as shown. A large wooden pulley was placed on the outboard end of the lathe spindle, and the motor was put on a sliding mount. With this arrangement, the motor could be moved sideways easily to drive either the wooden pulley or the step pulley on the lathe. The motor mount was made as shown, using a couple of brackets to support a long iron rod to which the motor stand was attached with a couple of heavy screw eyes. The motor mount "floats" on the supporting rod, which serves to keep the drive belt tight.

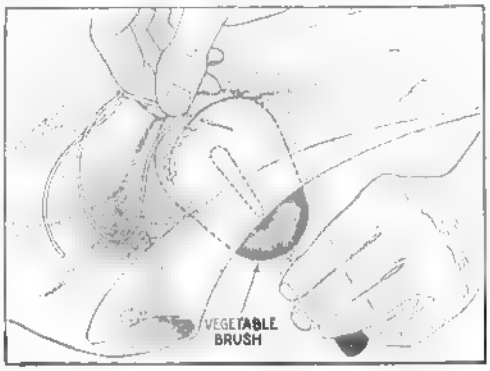
Kitchen Table Anchored Securely By Window Antirattlers

If your kitchen worktable is on casters, which permit it to move when rolling pie dough, etc., just attach window antirattlers of the type shown to two of the legs. These are screwed to wooden blocks, which are fastened directly to the legs with long screws or bolts. To anchor the table in one position turn the thumbscrews down until the table casters are lifted clear and the rubber tips of the thumbscrews rest on the floor. With this arrangement, no damage is done to the linoleum and the holding devices are hardly noticeable as they are mounted on the inside of the legs.



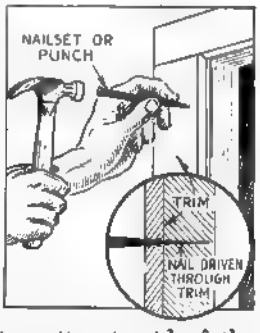
Brush Serves as Darning Egg When Mending Sweater

To hold together the torn edges of a sweater, or other loosely knit garment, in a handy position for mending, try a small vegetable brush, or hair brush, instead of the usual darning egg. The bristles of the brush will penetrate the knit fabric to hold it so that a darning needle can be worked through the material without the interference presented by the solid surface of the ordinary darning egg.



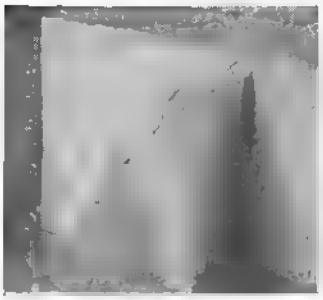
Interior Wood Trim Removed Without Marring Finish

When you have to remove interior wood trim from doors and windows, just drive the nails on through the wood with a nailset or straight punch. This avoids splitting the wood or splintering the edges with a pry bar. At the same time, it gets rid of the nails and permits the wood to be removed without the surface being marred by dents and scratches.

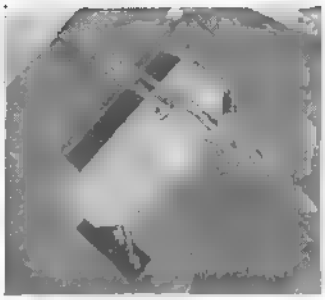


CRAFT QUIZ

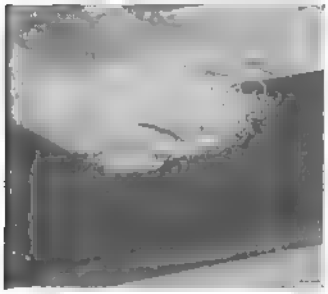
1. He is smoothing work with a—
   (a) Smoothing plane (c) Jack plane
   (b) Block plane (d) Rabbet plane



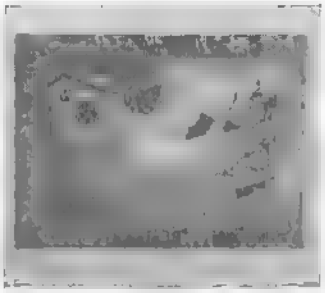
2. This circular saw is—
   (a) Swage set (c) Stagger set
   (b) Wave set (d) Spring set



3. Following up this job you need—
   (a) Dowel pins (c) Miter box
   (b) Splines (d) Plug cutter

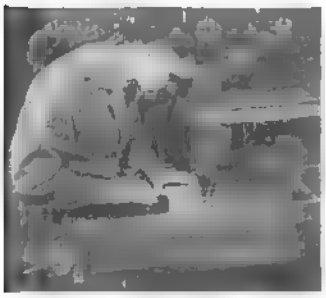


4. Wood filler often is wiped with—
   (a) Excelsior (c) Steel wool
   (b) Cellulose (d) Shredded paper



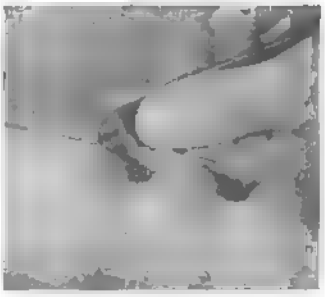
5. This inlaid picture is called—
   (a) Intarsia (c) Marquisette
   (b) Intaglio (d) Marquetry

6. He is using a—
   (a) Saber blade (c) Plain end blade
   (b) Pin blade (d) Band-saw blade



7. This job requires the use of a—
   (a) Rip fence (c) Dado head
   (b) Tenoner (d) Miter gauge

8. These cutters are part of a—
   (a) Dado head (c) Grooving saw
   (b) Coping head (d) Gang saw



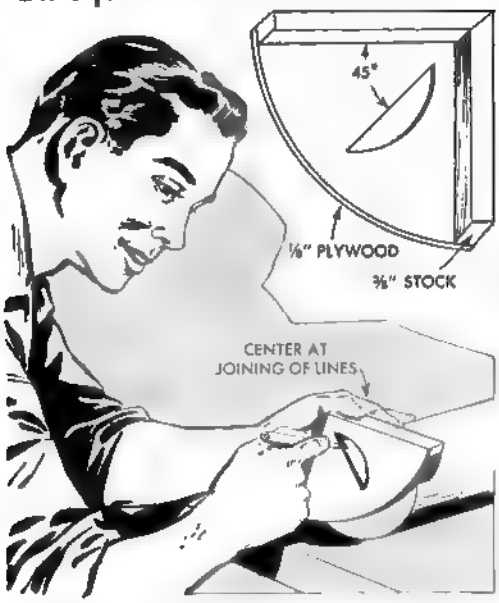
9. This turner is all set to cut a—
   (a) Cove (c) Bead
   (b) Fillet (d) Shoulder

10. Wood shingles on this dog house are—
    (a) Yellow pine (c) White oak
    (b) Red cedar (d) Select ash

11. The term for this wood bit is—
    (a) Solid center (c) Multi spur
    (b) Brad point (d) Double twist

ANSWERS:
1—c 2—d (teeth set alternately left and right); 3—b; 4—a; 5—d; 6—c 7—d; 8—a 9—a 10—b; 11—d

Marking Jig Locates Centers On Square or Round Stock

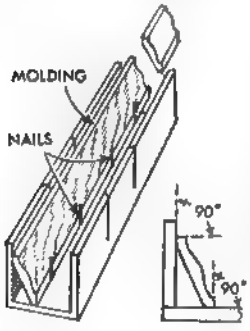


This jig makes quick work of locating and marking centers on square or round stock. To make it, cut a 90-deg. segment on a 5-in. radius from ⅛-in. plywood. Saw a half-moon opening in the segment with the straight side of the opening bisecting the 90-deg. angle. Then miter the ends of two pieces of ⅜ by ¾-in. stock and glue and brad these pieces to the plywood segment. To use the jig, place it on the end of the stock and draw a line along the straight edge of the opening with a sharp pencil or scriber. Move the jig approximately 90-deg. and scribe another line intersecting the first. The center of the stock will be at that point where the lines intersect.

J. Harold Click, Elkin, N. C.

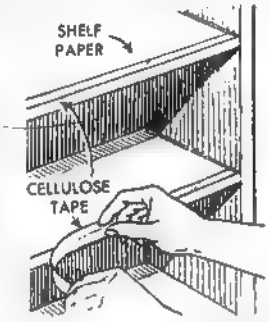
Sawing Cove Molding

With this simple miter-box setup, it is easy to cut accurately fitting joints in cove or crown molding wherever it is necessary to make a miter joint. It is done by placing the molding at the same angle in the box as it will be when nailed to the wall and ceiling. Finishing nails driven into the base of the box hold the molding in the correct position. When sawing, be sure to hold the molding firmly against the box to insure an accurate cut.



Aldo Gotta, Jamaica, L. I., N. Y.

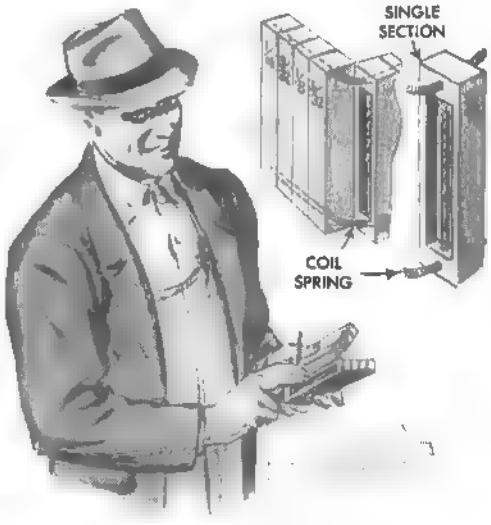
Cellulose Tape Holds Shelf Paper



Thumbtacking shelf-lining paper to cupboard or pantry shelves often results in the paper shifting and tearing at the points where it is held by the tacks. This will not occur if cellulose tape is used instead of thumbtacks. Simply apply half the width of the tape to the front edge of the paper and stick the other half to the edge of the shelf as shown. When shelving paper is used which has a decorative edging, small tabs of tape can be applied at each end and across the back to hold it.

Sectional Holder for Small Drills Carried in Pocket

A number of small twist drills can be carried in a pocket without tearing the cloth or dulling drills if this sectional holder is used. Each section consists of a wooden block that is hollowed out to hold a drill. The sections are held together by small coiled springs running through holes near the top and bottom of each section. Drill sizes are printed on the blocks for ease in selection. Note that a blank strip or block attached to the springs is required to cover the opening in one end block.



LICK COLD-WEATHER STARTING PROBLEMS

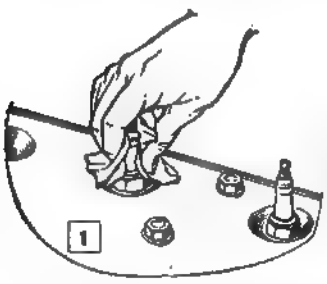
DO YOU step into your car on a cold morning with a doubt in your mind that the motor will start? It will if it is in good mechanical condition. And good mechanical condition does not necessarily refer to a new car. Unless your car has already passed the 50,000-mile mark, the chances are that a few simple checks of the fuel and ignition systems, to bring them to peak condition, will enable you to start the "old bus" on the coldest mornings.

Probably the most frequent cause of hard starting in winter is a weak or defective battery. As winter approaches, the load on the car battery increases. Also, as temperature lowers, the efficiency of the battery decreases. As the weather grows colder, careful drivers keep a check on the battery charge with a hydrometer, Fig. 8, and if periodic checks show that the load is steadily decreasing the hydrometer readings below 1.250, the charging rate is increased sufficiently to maintain the full-charge reading, 1.250 or slightly higher. Many motorists supplement normal generator charging with a trickle charger connected to the battery overnight. If the battery is more than a year old, it's a good precaution to take a voltmeter reading of each cell at least twice a year. If a defective cell is detected by this test, the battery should be replaced.

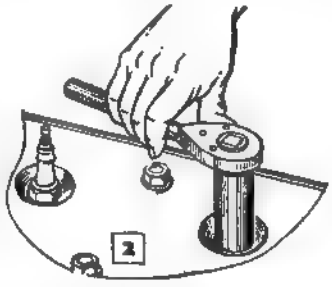
Defective or weak-battery symptoms also can be caused by a loose ground connection or badly corroded cable connections. Often it is necessary to make a careful check to be sure that one defect is not mistaken for another. Keeping all battery and ground connections clean and tight will avoid any trouble from this source.

Cars kept in unheated garages frequently give trouble in starting due to wet spark plugs. When the temperature rises after a cold snap the engine "sweats," due to moisture condensation. Moisture coats the plugs and cables and the high-tension current jumps from the

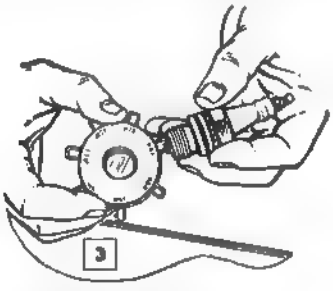
By Glen F. Stillwell



Wipe moisture from spark plugs and cables with a soft, dry cloth

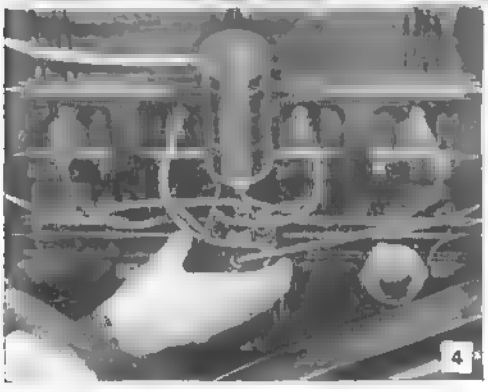


Use a deep-wall socket when tightening spark plugs to avoid breaks

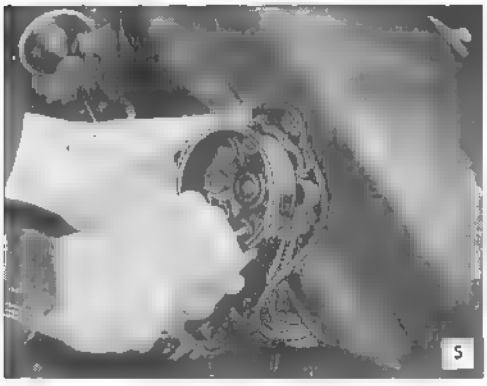


Check the electrode gap with a wire gauge made for the purpose

Overlubricating distributor may force grease into breaker mechanism and foul the points



Above, lift the distributor carefully to avoid damaging the gasket. Below, clean the inside of the cap thoroughly with a dry cloth. Examine cap inside and out for cracks. Also check condition of rain guards



plug terminal to the cylinder head, "shorting out" the plug. When this is the cause of failure to start, remove the cables and wipe the plugs and the cables with a dry cloth as in Fig. 1.

Exact gap spacing of the spark-plug electrodes, Fig. 3, is especially important in cold-weather operation of the car. Commonly recommended gap settings range from .025 to .029 in., but there are variations up to .040 in. Wide gaps and irregular gap settings in the same engine are a common cause of hard starting in cold weather. Some manufacturers recommend two settings, one for warm weather and another for cold-weather driving. In adjusting the gap always bend the side electrode and when removing plugs use a special spark-plug wrench or a deep-walled socket as in Fig. 2, to avoid cracking the porcelain. Make it a practice to clean the electrodes with fine sandpaper each time the plugs are removed. As plugs are replaced, always check the gaskets. Any that are scored should be renewed.

Making sure that the battery, battery cables and the spark plugs are in good condition eliminates a number of the common causes of wintertime starting troubles. This leaves the distributor still to be examined. Remove the cap, Fig. 4, and wipe the inside with a clean cloth, Fig. 5. Examine the cap carefully for cracks and indications of arcing. Unless the distributor is kept in good order by frequent cleaning and inspection, there is a tendency in some types of distributors for a dirt track to form inside the cap where the rotor contact travels. Here, fine dust, moisture and oil combine to form a heavy, sticky coating which in time will cause arcing, burn-

Remove rotor by pulling it off the driving shaft. When replacing be sure that it is properly positioned

Hydrometer readings of 1.250 or above normally indicate full battery charge. Check cells with voltmeter

ing and even cracking of the cap. Examine the top of the cap particularly for cracks. Be sure the spark-plug cables and the center cable from the coil make good electrical contact inside the socket terminals. Also be sure the rain guards over the cables fit tightly and have no cracks or wide breaks. Condition of the guards is especially important to good winter performance as they prevent moisture or a water splash from entering the distributor and suddenly "drowning" the ignition system.

Next, lift the rotor, Fig. 7, and examine the breaker mechanism. If the points are burned and deeply pitted so that they make only a partial contact, the parts should be renewed; also the condenser, which is a likely source of this trouble. On the other hand, if the parts seem to be in reasonably good condition, the points can be dressed to a true contact with a breaker-point file. The specified breaker-point gap ranges from .018 to .022 in. Check with a thickness gauge and set the gap according to the manufacturer's instructions. After setting the gap be sure the eccentric screw is tightened to hold the adjustment. Avoid overlubrication of the distributor shaft. Give the grease cup a turn or two after each 1000 miles, Fig. 6.

Automatic chokes generally have a winter and summer setting, which makes it possible to vary the richness of the starting mixture of fuel, and some are fitted with a fast-idle mechanism that simplifies starting a cold engine and gives better control during the warm-up period. The choke is operated automatically by a thermostatic control so located that it is actuated by changes in manifold temperature. Where the choke-control system includes a fast-idle control, the thermostat actuates not only the choke valve but also a vacuum valve or piston which measures the idling fuel mixture. As soon as the engine reaches normal operating temperature, the choke becomes inoperative, but as the engine cools after operation, all parts of the choke mechanism return to the starting position. By carefully following the manufacturer's directions for setting, anyone can adjust the automatic choke. On older cars equipped with manually operated chokes, correct operation depends on the skill of the driver. Overchoking will flood the engine and make it difficult if not impossible to start. Flooding also will dilute the crankcase oil with unburned fuel, which passes the pistons. Running with the engine partially choked also can result in rapid wear of cylinder walls and piston rings as the raw fuel washes away oil which normally reaches the upper part of the cylinders. Ordinarily, the trick in operating the manual choke is to synchronize operation of the choke with that of the starter so that a rich fuel mixture is drawn into each of the cylinders on the first intake stroke. After the engine starts, the choke is closed by stages until the engine has reached operating temperature.

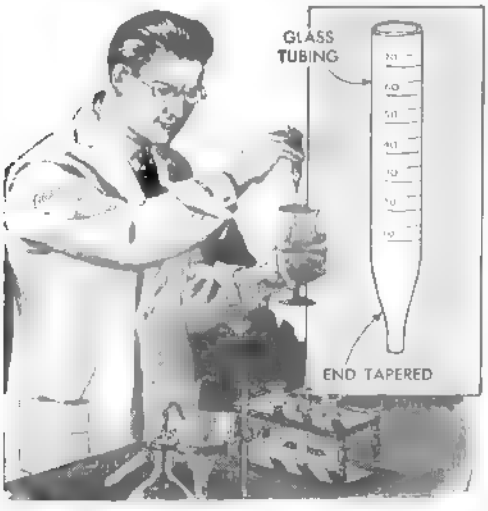
Poor compression due to leaky valves or worn rings causes hard starting any time. Such an engine needs both a valve and ring job to put it in proper condition for winter service. If poor compression is the cause of hard starting, an instrument check of the engine will show what parts are at fault. Sometimes a defective head gasket or possibly spark-plug gaskets are the cause of poor compression. These parts are quite commonly at fault in older cars.

Pen Flashlight Illuminates Level In Hard-to-See Corners

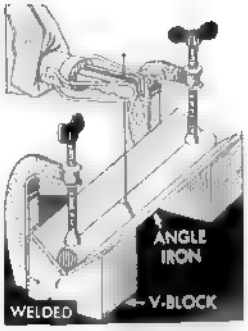
If you're working in a dim light and it's hard to read a level, this flashlight will be an aid. A groove is cut in the side of the level at such an angle that the beam from the light is directed on the spirit glass. The flashlight is held in place with a rubber strip and is removed easily when not in use. The idea can be applied to other tools.

Pipette Made From Glass Tubing Helps Laboratory Workers

Any graduations you want—ounces, fractions of an ounce, tablespoons or other units—can be marked on this pipette that is made from a length of ordinary glass tubing. One end of the tubing is drawn to a point over an open flame. Then the point is broken off so there is a small hole in this end. To mark the pipette, stop the tapered end and pour in one unit of the measure you are using. Mark this level with a file and continue pouring and marking until there are sufficient graduations to suit your purpose. In use, liquid is drawn in the tube to the desired level and held there by stopping the top of the tube with a finger. The fluid will be released when the finger is removed.



Welding Jig Holds Round Work



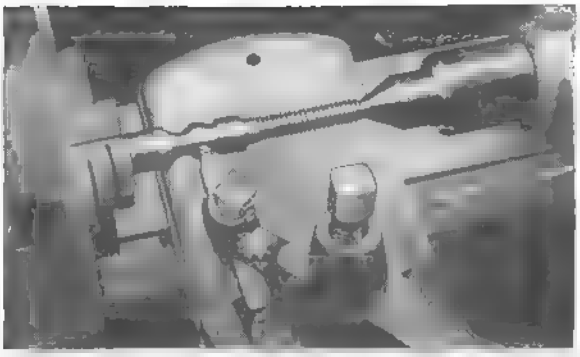
This jig will serve to align the parts properly and hold them in position when welding rods, large bolts and lengths of pipe. It consists of a length of angle iron that is mounted on two V-shaped metal blocks. The upper half of a C-clamp is fastened to each block and used to hold the work in place while the weld is being made. The work can be turned by loosening and re-tightening the clamps.

Sign Indicates Lack of Vacancies

To save time for himself and disappointment for travelers, one tourist camp proprietor had a sign made which would indicate whether he had any vacancies. The sign read, "No Cabins for Rent" with a pivoted cover placed over the word "No." When cabins were available, the cover was over the word "No" so the sign would inform travelers that there was space, but when all cabins were taken, the cover was swung down.

Metal Stakes for Building Lines

When laying out lines for an excavation, instead of using wooden stakes, one builder found that stakes of 1-in. angle iron served the purpose better, lasted longer, and were easier to handle and transport. The stakes should be long enough so that they remain driven in about 6 to 8 in. below the surface as the work progresses.



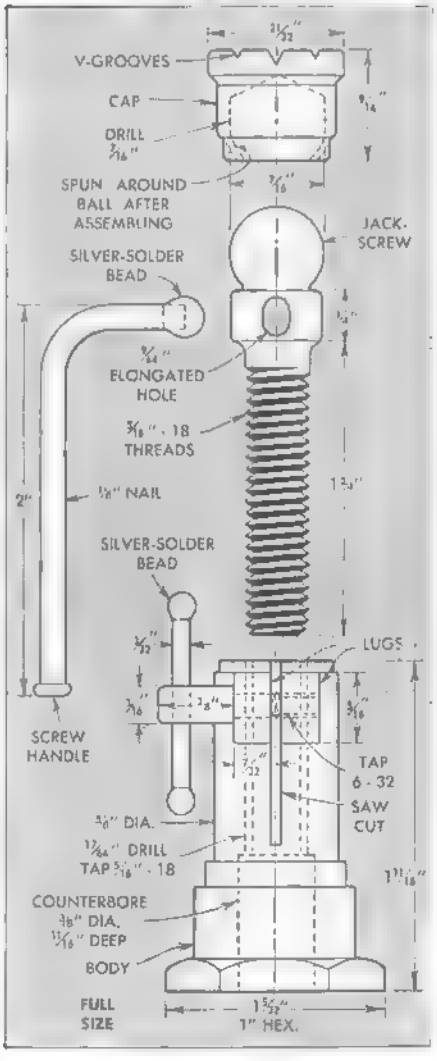
SMALL SCREW JACK
a metal-turning project

By Walter E. Burton

This little screw jack is really a jack-of-all-trades around the shop. The machinist will find it useful for leveling, internal-clamping operations in machine-tool setups and in assembly work. The jack consists of only ▮ parts and the necessary machining operations make it an excellent lathe project. The curved screw handle can be folded down against the body of the jack and a clamping arrangement permits the jackscrew to be locked without disturbing its position. The body of the original jack was made from a piece of 1-in. hexagon aluminum bar, although it can be turned from steel or brass. Other parts are of cold-rolled or hardenable tool steel, the latter being preferred for durability.

Begin making the jack by turning the body to the shape indicated, leaving a ridge about 5/16 in. long for the locking lugs. Next, drill and tap a hole through the body for the jackscrew, and slot the lug side of the body for at least half its length. Then shape and drill the lugs, reaming out one of them and tapping the other. After this, make the locking screw and drill ■ hole transversely through its unthreaded end to take a handle which is made from a nail or 3/32-in. steel wire. Silver-solder beads keep the handle from slipping out of the hole.

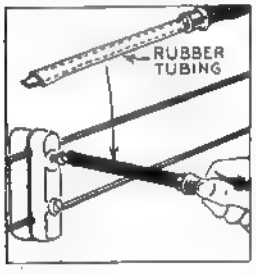
The jackscrew is turned and threaded as indicated and an elongated hole for the screw handle is made through the portion of the jackscrew just below the ball. The cap is machined and then recessed with a 7/16-in. twist drill. After completion of the parts, the ball is oiled and the joint assembled by hammering the cap edge around the ball or by spinning, that is, forcing the flat tip of a screwdriver against the edge while turning the assembly in the lathe. The cap should be able to tilt about 10 deg. from the vertical in all directions. The screw handle is made in the same way as the locking handle and V-grooves are filed or milled across the top of the cap to keep round work from slipping.



Damaged Tape Measure Repaired By Flowing Solder on Crack

Steel tape measures that have been cracked at the end can be repaired easily by flowing a little solder over the crack. This does not affect the operation of the flexible tape and will make it as serviceable as a new one. While the soldering iron is out, use should be made of another hint—tape cases that are made in two parts will also last much longer if the joint is soldered together.

Shield Prevents Electric Shock When Using Screwdriver

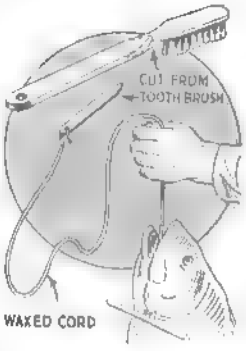


Slipped over the blade of a screwdriver, a length of small rubber tubing provides a shield that helps prevent accidental electric shocks when working around "hot" wires. Such a screwdriver is used by one electrician when he must work in places where there is a possibility of inadvertently touching the wires.

Worn Auger and Dowel Bits Useful in Drill Press

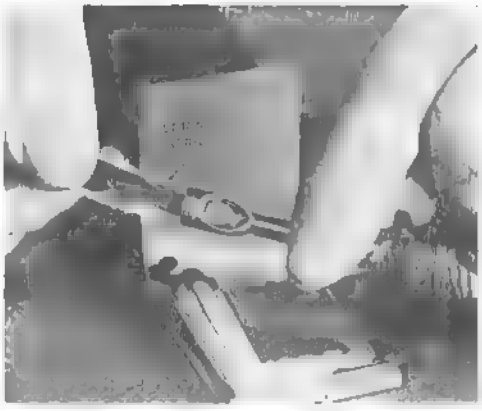
When auger and dowel bits used in a brace become unsuited for use, the square tang on the end can be cut off with a hacksaw, leaving a straight shank that will fit into a drill-press chuck. Under speed, the bit will cut clean holes in wood. In a drill press, the spur center cannot be used to feed the bit into the wood. A substitute for the bite of the spur center is provided by first drilling a pilot hole, about the size of the diameter of the spur. The auger bit then is fed by hand pressure as in metal drilling.

Improving Your Fish Stringer



Instead of using a piece of wire or wood on your fish stringer, get an old toothbrush handle and use it for the purpose. Just cut off the bristle portion of the brush and point one end of the handle. Usually the other end is already drilled so that the stringer can be tied to it. This makes a strong, serviceable point for the end of the stringer which slips through more smoothly than either wood or wire.

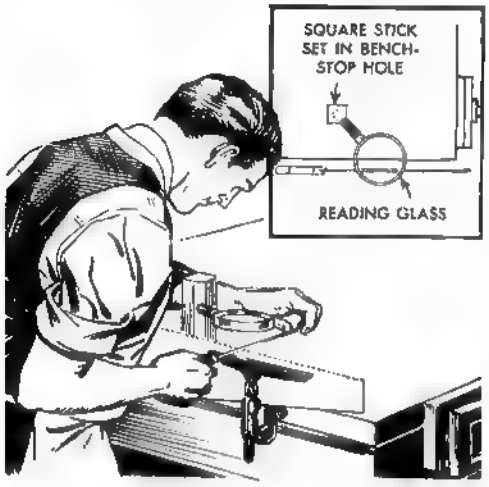
Emery Paper From Match Book Smooths Fishing-Rod Tip



If your fishing rod has a metal tip or guides that have become roughened to such a point that they might wear the line, you can smooth them easily with a strip of emery paper torn from the end of a match book. Roll the strip into a cone and insert it in the tip or guide with a twisting motion, repeating this procedure until the metal is smooth. The strip will also serve to clean the ferrules of a jointed rod if they become corroded from exposure to dampness.

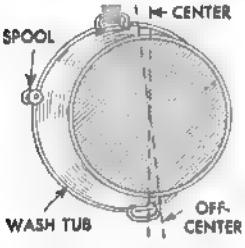
A set of combination ignition wrenches is carried easily on a shower-curtain ring on your belt.

Square Stick in Bench-Stop Hole Supports Magnifying Glass



While filing a fine-tooth saw, or doing other work requiring the use of a magnifying glass, you can have both hands free by supporting the glass on a stick shaped to a snug, sliding fit in the hole for your bench stop. All you have to do is drill a hole in the stick for the insertion of the handle of the magnifying glass. The stick can be raised or lowered to adjust the focus.

Rattling of Wash Tub in Wind Prevented by Spool



If you hang your wash tub on the outside wall of a building to dry and air out, it can be prevented from swaying in the wind and causing an annoying rattle by nailing an empty thread spool to the wall at one side of the tub. When doing this, hang the tub on its usual hook or nail and swing it slightly to one side while attaching the spool. This will assure that the tub rim rests firmly against the spool at all times.

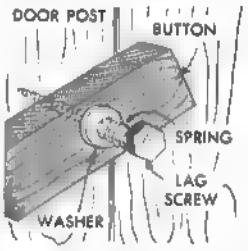
Replacing Oil and Gas Lines On Cars and Motorcycles

When it is necessary to install a new gas or oil line on a car or motorcycle and the original line is not at hand, many owners experience trouble in shaping the tubing, often resorting to the trial-and-error method of bending it into different shapes until the correct form is obtained. This repeated bending of the tubing weakens the metal and often causes it to fracture. To avoid this, use a piece of wire, which can be bent easily, to get the desired length and shape of line, and then bend the tubing to match the wire.

Magazine Pages Torn Straight After Scoring With Clip

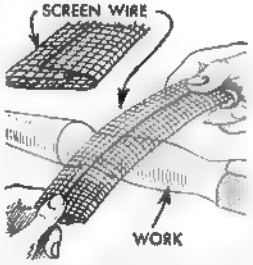
Next time you want to remove a number of pages from magazines and a knife or pair of scissors is not at hand, just straighten one side of a wire paper clip and draw it along the inside margins of the pages desired. Sharp edges on the ends of these clips scratch the paper in most magazines just enough so that it can be torn without leaving jagged edges.

Coil Spring Holds Door Button And Prevents It Jarring Loose



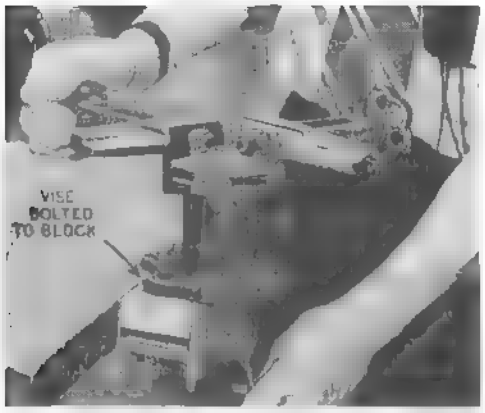
Doors on outbuildings that are held closed by wooden door buttons are often opened by the wind because vibration of the door causes the button to turn. To avoid this, attach the button in the usual way but put a small coil compression spring under the head of the screw which holds the button in place. This keeps a constant pressure against the button so that slight vibration will not cause it to turn.

Screen Wire Is Good Substitute For Abrasive Paper



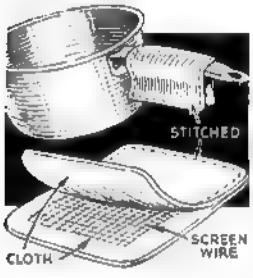
You will find that scrap pieces of screen wire will save a considerable amount of sandpaper in rough-sanding turned work in a lathe. The wire is folded over to provide a strip an inch or so in width and is used in the same manner as sandpaper, which, of course, must be used for the final smoothing since the wire leaves work rough to the touch.

Picture-Framing Vise Has Block To Clamp It in Bench Vise



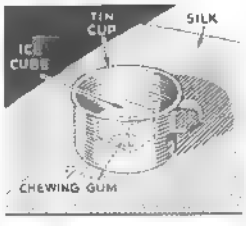
An easy way to handle a picture-framing vise when it is not used often enough to warrant fastening it permanently to the workbench, is to bolt it to a wood block, such as a piece of 2 by 4-in. stock, which can be clamped in your bench vise. In this way, the framing vise can be held securely, yet it can be set up or removed in a minute for storage, thus saving bench space.

Wire Inside Cloth Pot Holder Shapes It to Handle



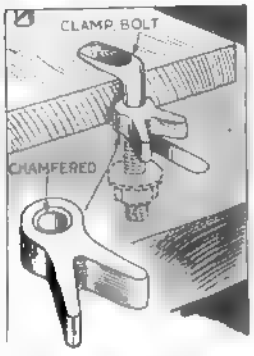
To make a cloth pot holder stay in place on the handle of a utensil where it would be convenient when needed, one lady stitched a square of screen wire between the cloth thicknesses of the pad. In this way, the wire will make the holder remain in place on the handle.

Gum Removed From Clothing By Using an Ice Cube



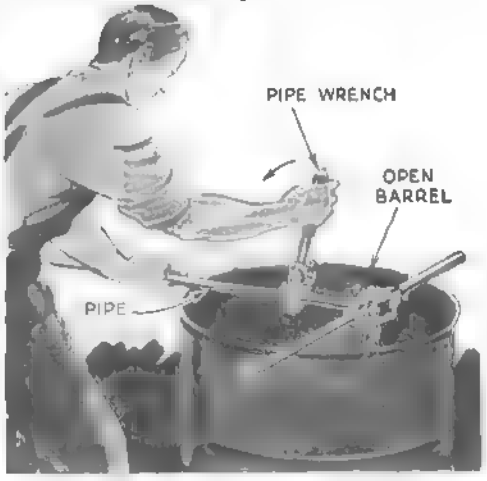
While ice often is used to chill and harden chewing gum on clothing, it is impractical to use the ice on fabrics that may be stained by water. For such fabrics, one cleaner places the ice in a tin cup and applies this to the gum. Care should be taken to wipe moisture from the cup before placing it on the garment. If moisture collects rapidly, put a sheet of wax paper between the cup and the gum.

Heel Improves L-Clamp Bolt



An L-clamp bolt used on a drill press and faceplate can be improved by the addition of a Y-shaped heel of the type shown. This helps prevent any tendency of the bolt to spring away from the work. The heel should be an easy fit on the bolt, and the upper edge of the hole is chamfered.

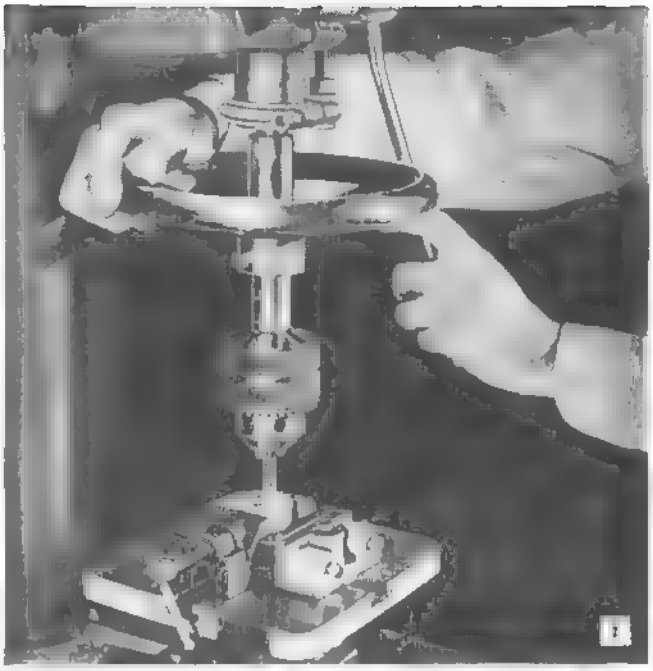
Barrel Used as Pipe Holder On an Emergency Job



A plumber who was called on an emeragency plumbing job had some pipe to thread and no pipe vise was available for holding it. He solved the problem by laying the die stock across the top of an open barrel as shown. The pipe was inserted into the die and then was turned with a pipe wrench to thread it. Any barrel with one end removed will do for this purpose.

Thumbtack Plugs Cement Tube

A cement or glue tube from which the screw-type plug has been lost can be capped by inserting a thumbtack in the tube opening. The tack is easy to grip and, since it does not have to be turned, is removed and replaced more easily than the original.

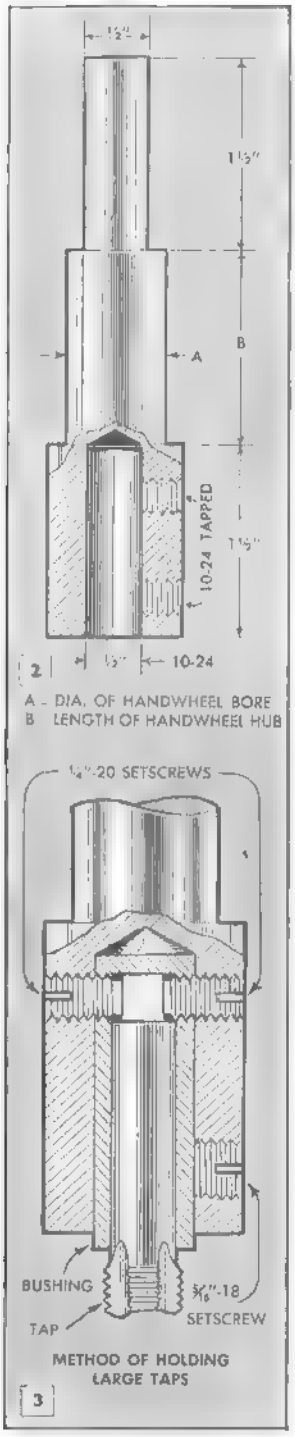


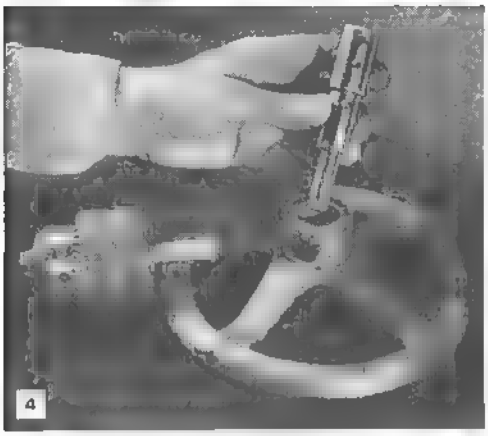
DRILL-PRESS TAPPING ATTACHMENT

By Walter E. Burton

THIS ATTACHMENT makes a hand tapping machine of any small drill press. The unit utilizes the accuracy of the machine to guide the tap squarely into the hole, a trick that is quite difficult to do by hand with an ordinary tap wrench. Fig. 1 shows the unit in operation. By using the hand feed of the drill press and turning the tap with the large handwheel, a delicate feed is obtained which avoids tap breakage. No power is used, the tapping being done by hand.

To make the attachment, you need a true-running handwheel 8 in. in diameter, a length of 1-in. cold-rolled-steel shafting for the adapter, a key-operated chuck of ½-in. capacity, and several socket-head setscrews. The exact method of machining the adapter will depend on the type of spindle on the drill press and the method of mounting the tapping chuck. The adapter shown in Figs. 1 and 2 is attached to a drill-press spindle having a collar with a ½-in. hole and two setscrews for holding router bits, etc. It takes ■ drill chuck fitted with a ½-in. straight shank. Fig. 2 details the adapter for a straight-shanked chuck. It is machined all over and shouldered to three diameters. The hole drilled in the large end is reamed to finish diameter. Transverse holes are drilled and tapped for 10-24 socket-head setscrews. Machine the



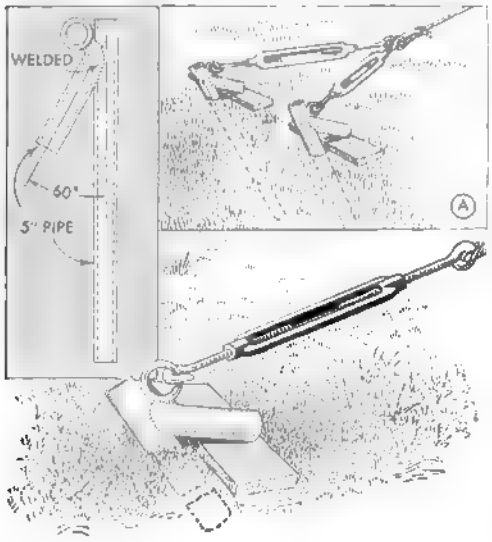


other end of the adapter, Fig. 2, to a diameter of ½ in. for a distance of about 1½ in. This diameter will fit most drill-press spindles of the type shown. Drill and tap the handwheel hub for a 5/16-in. No. 18 socket-head setscrew. File a flat on the middle section of the adapter to provide a seat for the handwheel setscrew, and then bore and ream the handwheel hub to a tight slip fit.

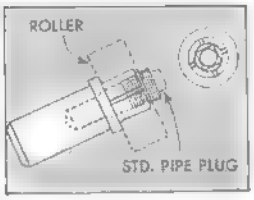
A key-type chuck like that shown is satisfactory for taps up to ⅜ in., but for larger taps a special chuck, Fig. 3, is needed. In construction, this is similar to the adapter shown in Fig. 2, except that it holds the tap by means of setscrews and bushings, several of which are made to fit varying sizes of taps. Notice that ¼-in. No. 20 setscrews turn into holes drilled and tapped through both the adapter sleeve and the bushing, Fig. 3. The setscrews seat on the squared end of the tap, making a positive nonslip drive. The detail shows a closed-end bushing, the closed end acting as a stop when the tap is inserted. This provision is handy on short-run production, but open-end bushings can be used, of course. Fig. 4 shows the three parts of the unit required for installation on the average drill press. Careful machine work is necessary as any misalignment will cause repeated tap breakage. Work must be mounted securely on the drill-press table and tap holes should be drilled with the drill press to assure accuracy.

Pipe-and-Spud Guy Hitch Holds Fast in Marshy or Sandy Ground

When it is necessary to guy derricks, cranes or other equipment in marshy or sandy soil where it is impractical to dig a pit for a deadman, the hitch shown will effectively anchor the guy. This hitch is made from a length of 5 or 6-in.-dia. pipe with the ends left open to enable it to be driven into the ground. A spud about 2 ft. long is welded at a 60-deg. angle near the upper end of the pipe, and an eye for a turnbuckle hook is welded just above the junction of the pipe and spud. To use this hitch, drive the pipe into the ground so that the spud is almost flush with the surface and rest the end of the spud on a short plank placed at right angles to the direction of pull. The pressure of the spud against the plank and the resistance of the lower end of the pipe to being forced backward, hold the hitch securely. One of the main causes of a hitch gradually working loose is the transmission of vibration from the guy to the hitch. This often can be remedied by using two hitches, as shown in detail A, with the turnbuckles adjusted so that their lengths are unequal. This method also is efficient if two ordinary iron stakes are used for the hitches instead of the special pipe-and-spud assembly.—Elton Sterrett, Houston, Tex.

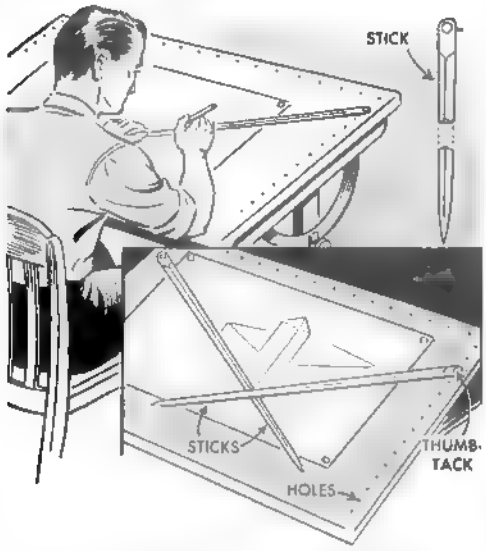


Mandrel Expands to Hold Work



If you have a number of rollers or similar items to face, this expanding mandrel will permit them to be mounted and removed from the lathe rapidly. Turn a shoulder on the mandrel to seat squarely in a 4-jaw chuck. Then drill, tap and slot end, as shown, to take a pipe plug. Tightening the plug after the work is mounted expands the end to hold the work.

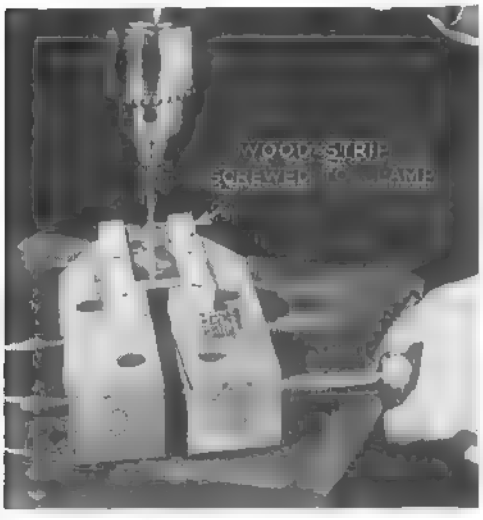
Sticks Pivoted to Drawing Board Aid in Making Perspectives



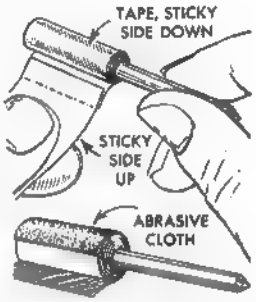
Two sticks shaped as indicated will be found an aid in making perspective drawings. They are pointed at one end and flattened at the other end to take thumbtacks, which serve as pivots. The tacks are inserted in holes drilled at equal intervals along the sides and top of the drawing board to get the desired angles for balanced perspective.

Wood Strips on Handscrew Jaws Hold Work in Drill Press

An excellent drill-press vise, especially suitable for holding thin metal for drilling, can be made by screwing wood strips to the jaws of an ordinary handscrew. An adjustable-type handscrew is preferable, as this style will grip wedge-shaped pieces as well as rectangular and square work. The strips are ⅜ by ½ by 4½ in., and are fitted ¼ in. in from the inner edge of the jaws. They do not interfere with normal use of the handscrew. The handscrew handle should be gripped by hand to prevent rotation of the work.



Hand-Grinder Sanding Drum Made From Abrasive Cloth

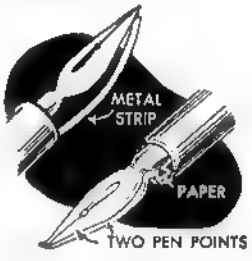


Small sanding drums for use on hand grinders can be improvised by attaching abrasive cloth to steel rods, which serve as mandrels. To attach the cloth, first wind several turns of adhesive tape, sticky side down, on the rod, cutting off the tape to leave a small tab. Then turn the roll of tape around, attach it to the tag end, sticky side up, and wind it again until the drum is of the desired diameter. Now cut a strip of the abrasive cloth to a size that will produce exactly one turn around the drum and press it in place.

Strike Plate Plugged With Screw Prevents Locking Door

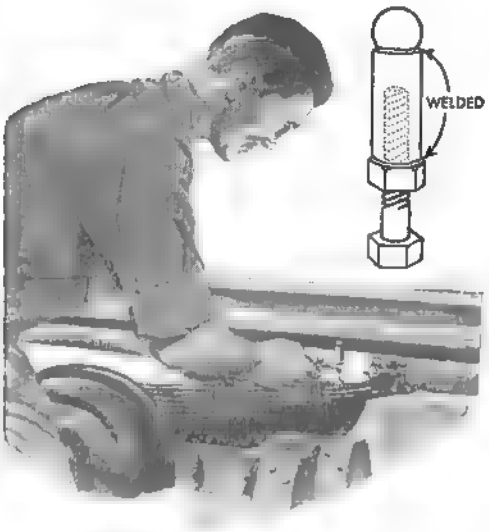
To prevent his small son from locking himself in a room, one man drove a screw into the bolt opening of the strike plate flush with the plate. The screw prevented the bolt from entering the plate, yet could be removed quickly whenever it was desirable to lock the room.

Ink Reservoir Added to Pens



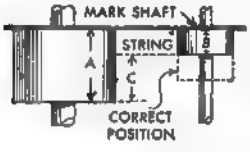
By fitting a narrow strip of thin metal in a pen holder and curving the strip so that it touches the pen just behind the tip, a reservoir will be formed to hold the ink, thus permitting the pen to be used for longer periods. Another way of creating an ink reservoir is to lay one pen over another with paper between the shanks for a spacer. The tip of the under pen should be bent upward slightly to touch the other, care being taken to avoid scratching the tip when this is done.

Handy Four-Piece Jackscrew For Close Quarters



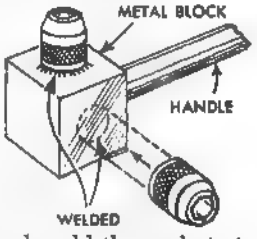
Especially useful in making auto-spring repairs, this handy little jackscrew will have many other uses in both garage and machine shop. Just four parts are needed to make it, a steel ball, pipe nipple, and a cap screw and nut. The nut is welded to one end of the nipple and the steel ball to the other end, although the jack can be used with the ball simply resting in the end of the nipple. If the ball is welded in place, a stainless-steel welding rod must be used. The length of the nipple can be made to suit the job at hand. To use the jackscrew, the bolt is turned into the nut as far as necessary, and then an open end wrench is used to back the nut off the bolt, the latter remaining stationary as the upper part turns with the steel ball.

Centering Flat-Belt Pulleys



Lining up flat-belt pulleys of the same width is not difficult because it is merely a matter of aligning the rims, but where the widths of the faces differ, alignment is more difficult. Here is one way to do it: Assuming that the shafts are in alignment, line up one side of the rims of the pulleys by using a length of string or a straightedge and mark the position on the relative shafts. Then measure distances A and B. Subtract B from A to obtain C and halve the result. The answer is the distance that the narrower pulley must be moved away from its mark on the shaft. To illustrate this, if A is 9 in. and B is 3 in., the difference is 6 in. One-half of this is 3 in. Therefore, the narrower pulley must be moved 3 in.—W. F. Schaphorst, Newark, N. J.

Multiple Wrench Has "Turret Head"



Instead of having to carry four sockets and a wrench handle when working on a car, make a multiple tool which has all four sockets in one head. Use a solid metal block for the head and weld the sockets to it, making a light weld to avoid heating them and withdrawing the temper. If the sockets are alloy steel, it will be necessary to use a special welding rod designed for that particular metal.

Doorknob "Eggs" in Hens' Nests Fatal to Egg-Stealing Snakes

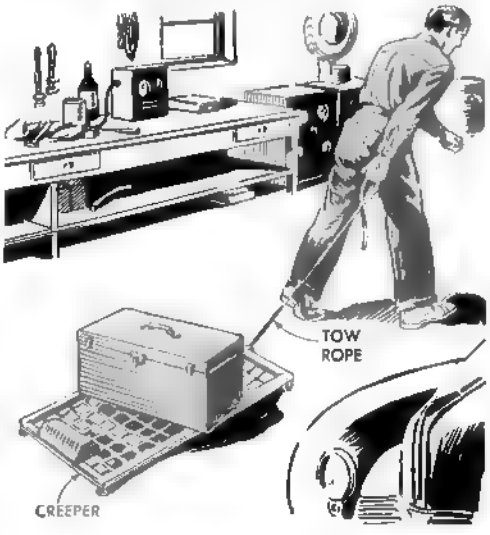
One farmer found that when he placed white doorknobs in hens' nests, egg-eating snakes, believing they were eggs, would swallow them and die. By doing this, he was able to rid his buildings of the pests.

William Allen Ward, Dallas, Tex.

Creeper Used as Dolly

If a towrope is tied to a creeper, it will serve as a dolly to move large tool chests about the garage. This eliminates the necessity of having two men carry the box. A large number of repair parts can be moved in the same manner.

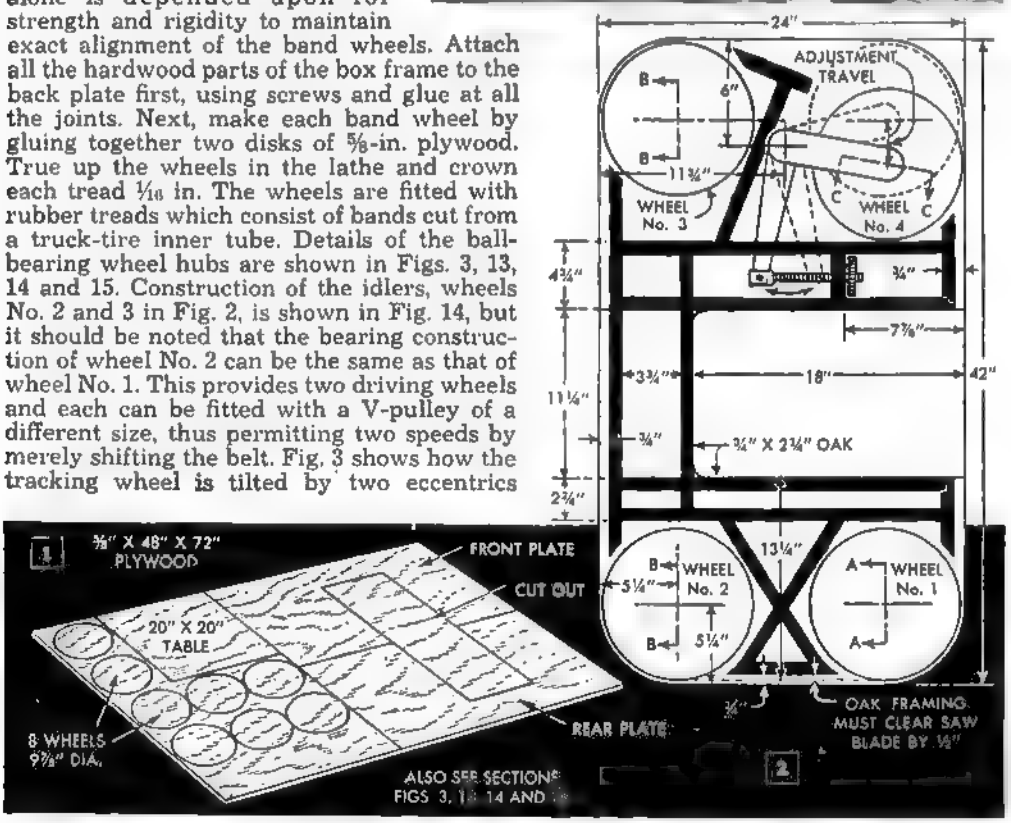
Marvin H. Doughlass, New Bern, N. C.

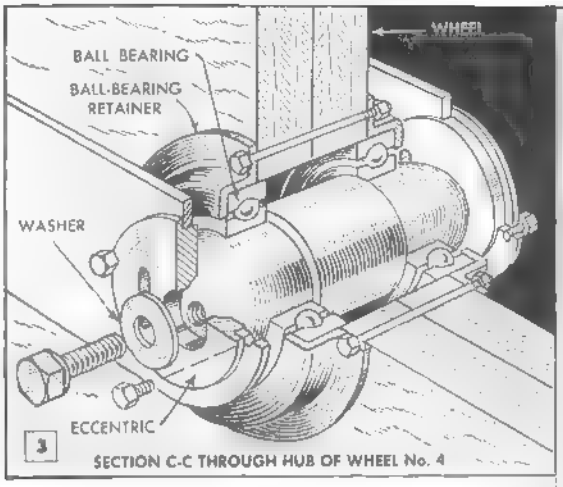


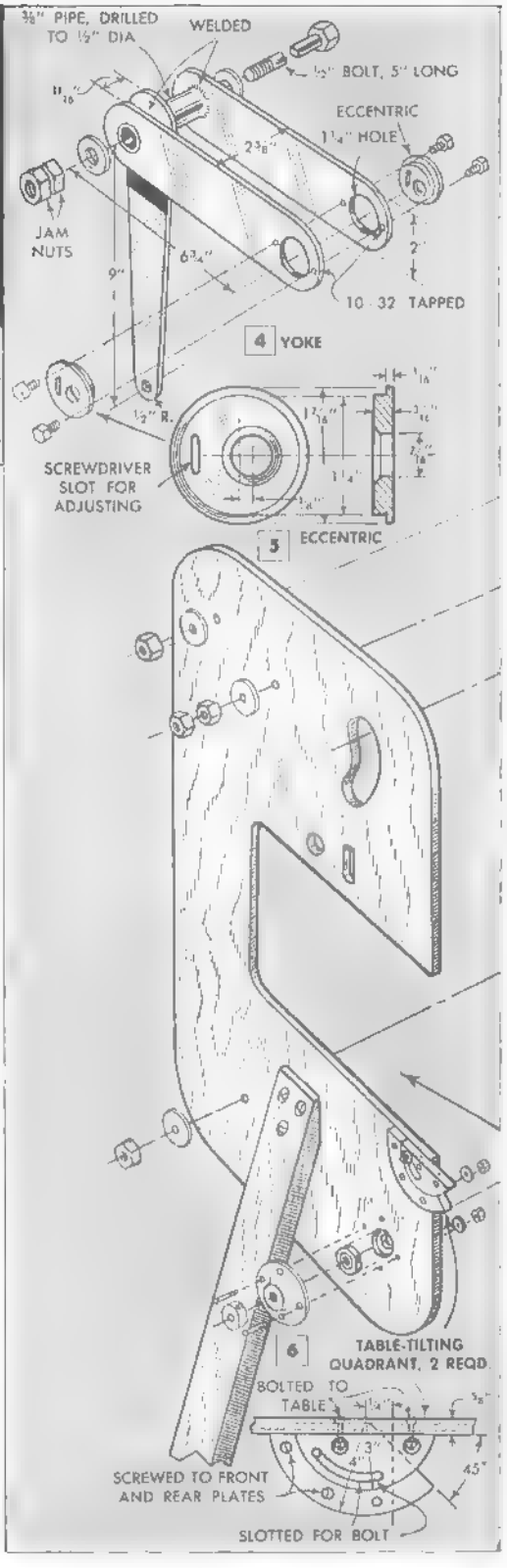
4-Wheel BANDSAW

By
H. Tuttle and R. E. Knull

BY USING four band wheels instead of two, big-machine capacity is built into this bandsaw of home-workshop size. The 18-in. throat makes it possible to work at the center of panels up to 36 in. wide. Except for ball bearings and retainers, metal yokes, sheet-metal cover, and such shafts and bolts as are necessary in the assembly, the machine is made entirely of wood. Most of the parts are cut from a single piece of ⅝-in. plywood as in Fig. 1. The box-type spacer frame between the front and back plywood cover plates, Figs. 2 and 8, is made from oak. When assembling the frame, special care must be taken to build it to exact dimensions, as the frame alone is depended upon for strength and rigidity to maintain exact alignment of the band wheels. Attach all the hardwood parts of the box frame to the back plate first, using screws and glue at all the joints. Next, make each band wheel by gluing together two disks of ⅝-in. plywood. True up the wheels in the lathe and crown each tread ⅛ in. The wheels are fitted with rubber treads which consist of bands cut from a truck-tire inner tube. Details of the ball-bearing wheel hubs are shown in Figs. 3, 13, 14 and 15. Construction of the idlers, wheels No. 2 and 3 in Fig. 2, is shown in Fig. 14, but it should be noted that the bearing construction of wheel No. 2 can be the same as that of wheel No. 1. This provides two driving wheels and each can be fitted with a V-pulley of a different size, thus permitting two speeds by merely shifting the belt. Fig. 3 shows how the tracking wheel is tilted by two eccentrics

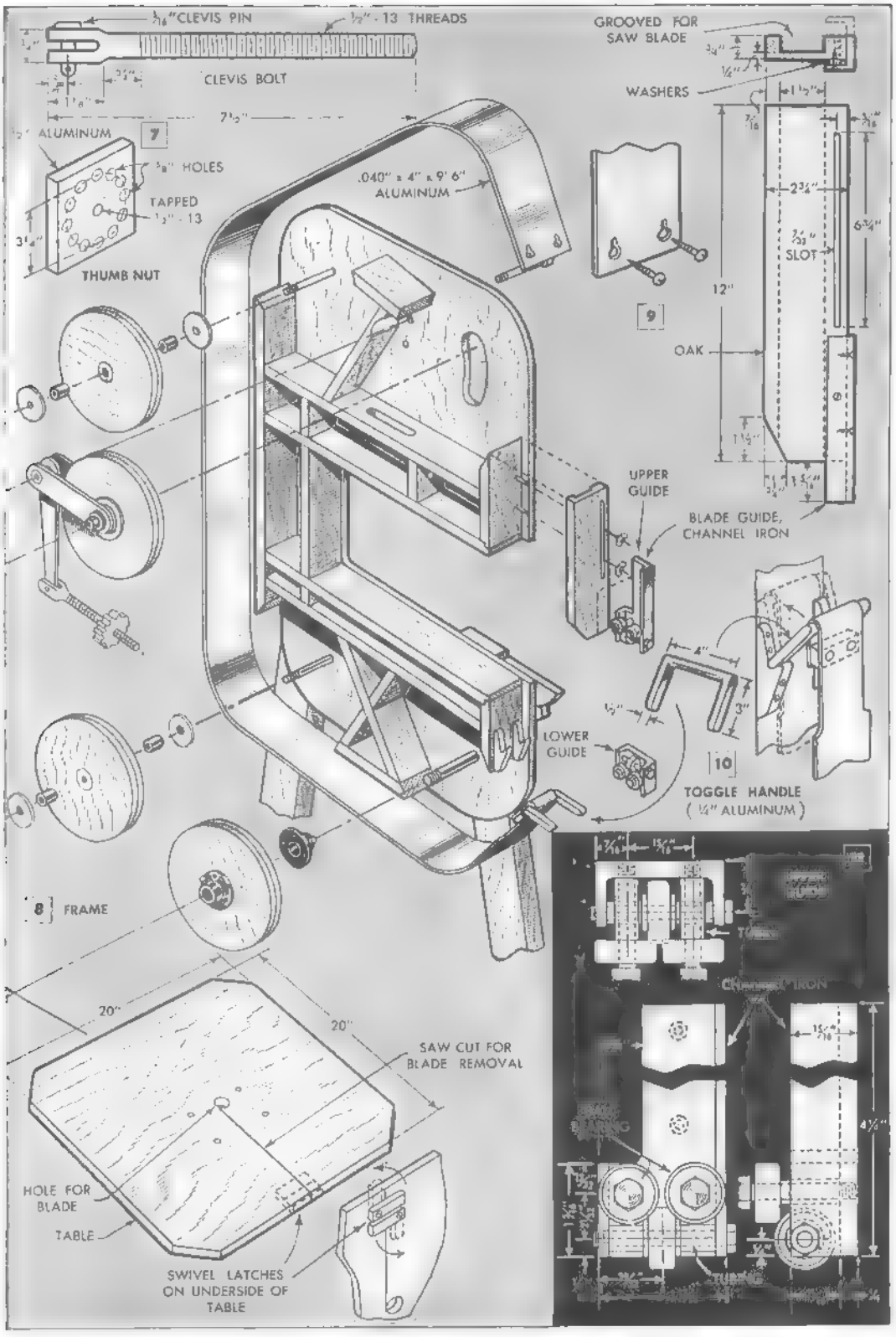


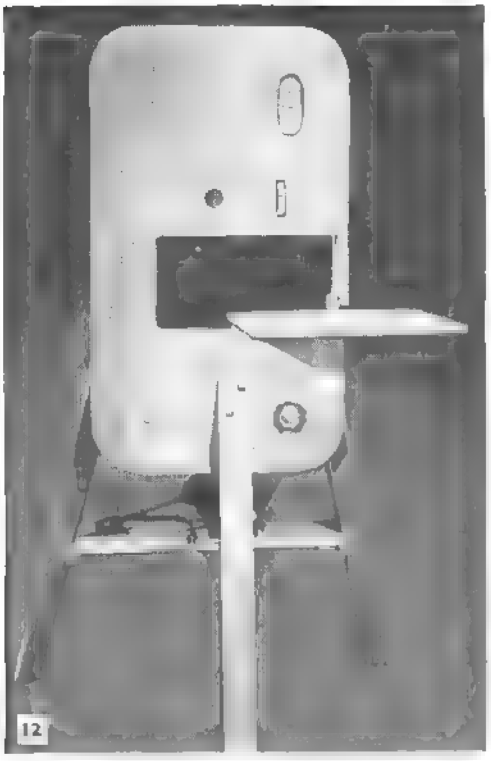




which support the shouldered shaft on which the wheel bearings are mounted. The sectional view, Fig. 15, shows the assembly of the bearing with the eccentrics mounted on the tensioning yoke. Construction of the eccentrics and yoke is shown in Figs. 4 and 5.

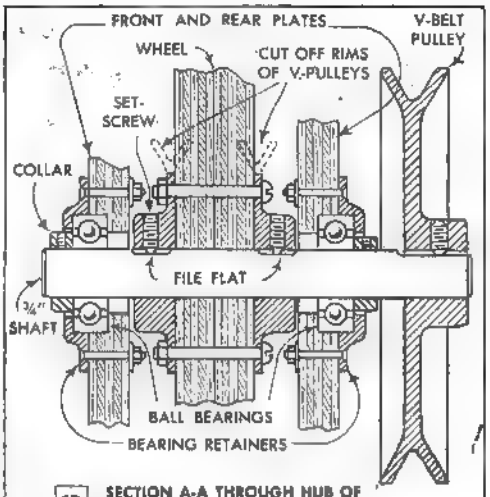
Locate the wheel centers on both the front and back plates and cut the curved access slots in both plates to expose the hub of the tracking wheel. Then mount the tracking wheel on the yoke and pivot the wheel unit in the frame. After attaching the clevis bolt and the thumb nut, Fig. 7, mount the front plate with screws only, so that it may be removed if necessary. Install the upper and lower idlers, checking to see that they line up. Note that holes for the driving-wheel bearings are counterbored in both the front and back plates, Fig. 13. This must be done with care so that when in place the wheel will line up with the other three wheels. Now, mount the machine on its three hardwood legs to stand at a convenient working height. The table, Fig. 8, is slotted in from one edge to a hole drilled at the center to allow easy removal of the blade. Swivel latches are fitted near the edge on the underside to level the adjoining sections of the table. Hardwood tilting quadrants, or trunnions, are bolted to the bottom of the table in the manner shown in Fig. 6. Lower halves of the trunnions are screwed to the front and rear plates. A locking bolt, passing through curved slots cut in the upper halves of the two trunnions, provides a means of locking the table in both the level and tilted positions. A leveling bolt is attached to the frame at some point under the table. Both blade guides, the upper one being detailed in Fig. 11, consist of three ball bearings mounted between the legs of a piece of channel iron. The lower guide is the shorter of the two and is bolted to the box frame, Fig. 8, while the upper guide is bolted to a length of hardwood, grooved as in Fig. 9 to allow for


5/16" CLEVIS PIN
1/2" - 13 THREADS
CLEVIS BOLT
7 1/2"
1/2" ALUMINUM
7
5/8" HOLES
TAPPED 1/2" - 13
3 1/4"
THUMB NUT
.040" x 4" x 9' 6" ALUMINUM
GROOVED FOR SAW BLADE
WASHERS
1 1/2"
2 3/4"
6 3/4"
SLOT
12"
9
OAK
UPPER GUIDE
BLADE GUIDE, CHANNEL IRON
LOWER GUIDE
10
TOGGLE HANDLE
(1/4" ALUMINUM)
8 FRAME
20"
20"
SAW CUT FOR BLADE REMOVAL
HOLE FOR BLADE
TABLE
SWIVEL LATCHES ON UNDERSIDE OF TABLE
4 1/4"

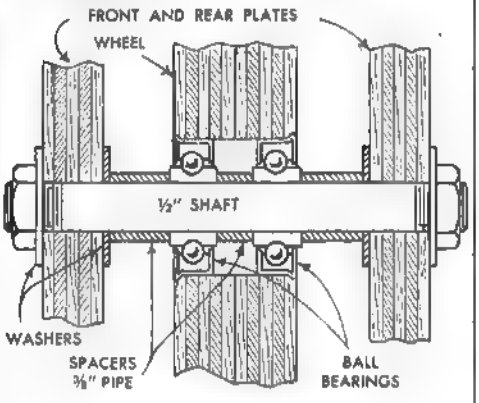


12

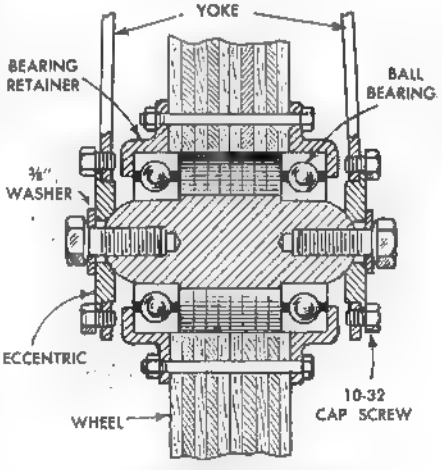
clear passage of the blade. Note how the hardwood support is slotted and attached to the frame so that the guide can be moved up and down to clear different thicknesses of stock. Projecting edges of the front and back plates serve as a guide for the hardwood supports. Blade length on the original machine is 10 ft. (120 in.), and blades up to ½ in. wide may be used, although narrower blades have a somewhat longer life. After installing the blade, check alignment on the wheels, adjusting the tracking wheel and guides so that the blade runs smoothly and centers on the wheels. Set the guides so that all three rollers turn when the blade is moved, but be sure that they are not too tight, as this will cause the blade to vibrate and possibly break. Then, make and fit the sheet-metal cover. The toggle handle, Fig. 10, provides a quick, easy way of locking the cover in place. Attach the motor support to the two back legs, as in Fig. 12. The position of the support depends on the length of V-belt used. Although a ⅓-hp. motor will supply ample power for light work, a ½-hp. motor is recommended as being more satisfactory for all-around work. The speed of the band wheels should not exceed 600 r.p.m. for the best results in average woodworking. For cutting light metals the speed of the band wheels should be reduced and a metal-cutting blade used.



13 SECTION A-A THROUGH HUB OF WHEEL No. 1 (DRIVING WHEEL)

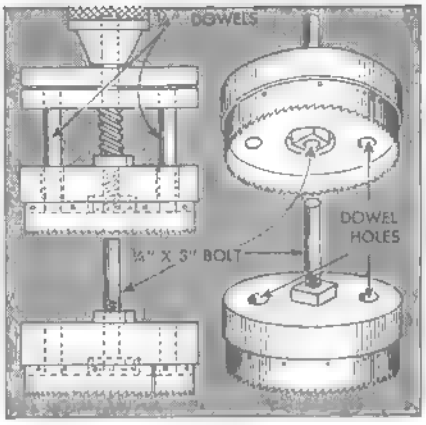


14 SECTION B-B THROUGH HUBS OF WHEELS No. 2 AND No. 3 (IDLERS)



15 SECTION C-C THROUGH HUB OF WHEEL No. 4 (TRACKING WHEEL)

Homemade Hole Saw Increases Production By Removing Disk While Machine Is Running



Here is a hole-saw attachment for a drill press that speeds up the cutting operation by permitting the stock removed to be ejected from the tool while the drill press is running. Using an ordinary hacksaw blade, wood up to ¼ in. thick can be cut. A wider blade, of course, allows working with heavier stock. A 12-in. hacksaw blade will provide a saw with a maximum diameter of about 3½ in. The tool is made by cutting a disk from ¾-in. wood about ¼ in. larger in diameter than the desired size of the saw. Then, the disk is drilled to take a ¼ by 3-in. bolt, countersinking the bottom of the disk for the nut. It also is drilled for two ¼-in. dowels. The head of the bolt is cut off so it can be chucked in the drill press and it is fastened to the cutter as shown. A shoulder 3/16 in. wide is turned on the underside of the disk to the exact diameter of the finished tool. This may be done by chucking the unit in the drill press and improvising a tool rest. To mount the hacksaw blade, heat it to a dull red and cut off one end square. Next, drill small holes near the top edge of the blade at intervals of about 1 in. Heat the blade again, if necessary, and bend it to the desired radius. However, be sure to bend the blade so that the teeth will be in proper cutting position after it is mounted. Finally, nail the blade to the cutter disk, starting with the squared end, and trim the other end to fit snugly against it. The ejecting mechanism consists of two disks of ¼-in. plywood drilled to slide over the bolt. The lower disk is fitted with ¼-in. dowels aligned with the holes in the cutter disk. A spring and then the lower disk are placed over the bolt, and dowels are inserted in the holes. The upper surface of this disk is waxed to permit the top disk to be grasped during operation without interfering with the rotation of the cutter. The drill-press chuck serves as a stop for the spring. In operation, the top disk is pushed down after the stock is cut. This forces the dowels through the holes in the cutter disk, ejecting the material in the center of the saw.

Ralph S. Wilkes, Elbridge, N. Y.

Push-Button Switch Operates Starter When Adjusting Valve Tappets

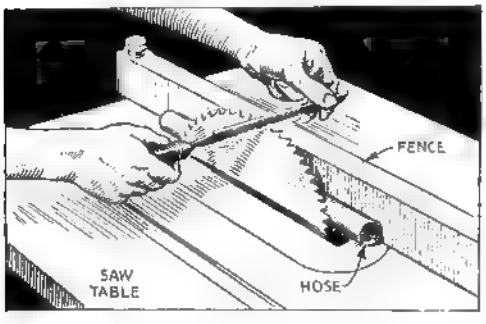
When adjusting valve tappets on new-model cars that are not provided with a crank and have solenoid-type starter switches, difficulty of turning over the motor can be overcome by using a portable switch of the type shown. This consists of a doorbell push button connected to two lengths of insulated wire which terminate in small battery clamps. Each of these wires should be several feet long so that when clamped to the solenoid and to the ground, the push button can be placed within easy reach. In this way, the mechanic can turn over the motor to bring the valve push rods into proper position by pressing on the push button. On cars not having solenoid starter switches, a regular starter switch or a heavy-duty switch should be substituted for the push button to carry the heavy current necessary.

Funnel Dasher Mixes Solution Used to Spray Trees

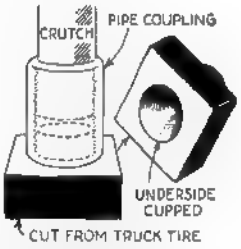
To speed up the dissolving and mixing of chemicals for his orchard-spraying machine, one farmer wired a large funnel to the stirring stick. By churning this up and down in the mixing barrel, the liquid was agitated violently, and the solids were carried up through the spout instead of merely rotating around the bottom of the container, and were dissolved quickly.

Rubber-Hose Wedge Holds Saw While Filing It on Mandrel

The next time you want to touch up the teeth of your circular saw with a file, just wedge a piece of rubber hose between the saw and the ripping fence. This will prevent the saw from turning, and will also silence any tendency to screech caused by drawing the file across the teeth.

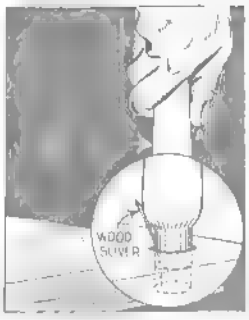


Crutch Tips From Truck Tire



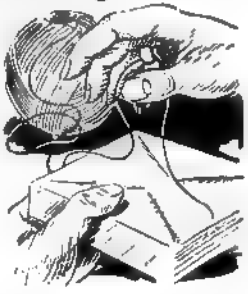
Long-wearing crutch tips can be made from the thick, tough rubber of old truck tires. The tips are cut to shape and then forced into pipe couplings screwed onto the ends of the crutches. For use on sidewalks and hard ground, tips shaped like the one shown are ideal. If you do much walking on soft ground where the tips are likely to sink into it, the tips can be made larger to prevent this.

Wood Sliver Vents Glued Dowel For Easy Driving



When a dowel isn't grooved to vent it while driving, you can accomplish the same thing by using a thin sliver of wood. Just insert the sliver at the edge of the hole as shown, and drive in the dowel. After this has been done, the sliver can be cut off flush with the surface after the joint is completed.

Finger Ring Keeps Twine Handy When Wrapping Packages



Slip the twine through your finger ring, as indicated, the next time you have a number of packages to wrap. In this position, the end will always be at hand when a package is ready.

Before reshaping a bolt head on a grinder, try turning a nut halfway up the threads of the bolt. The nut absorbs the heat so that the bolt can be held comfortably in the fingers even though it becomes quite hot.

ADAPTER PLATE

By Frank Faber

OWNERS of small metal-turning lathes will find an adapter plate a handy accessory to have when machining duplicate parts and work that is too large to be chucked. Mounted on top of the compound rest in place of the tool post, the adapter plate becomes an integral part of, and swings with, the compound so that duplicate machining operations on multiple setups can be done in a manner similar to using a turrethead. In addition, the adapter plate permits a drill vise or angle plate to be used to hold the work. This arrangement provides a fast and positive means of clamping the work at just the right height. A few of the various setups that the adapter plate makes possible are pictured in the series of three photos.

The adapter plate consists of three main parts: a surface plate which has tapped holes in the top and edges for hold-down fixtures, a tongue which fits the narrow width of the T-slot, and an anchor plate which clamps the unit to the compound by means of two socket-head machine screws. The tongue is fastened to the underside of the plate with two flat-headed screws set flush in tapped holes. Dowel pins, in addition to the screws, are used to anchor the tongue rigidly. The tapped holes in the plate are located according to the drawing and are chamfered slightly.

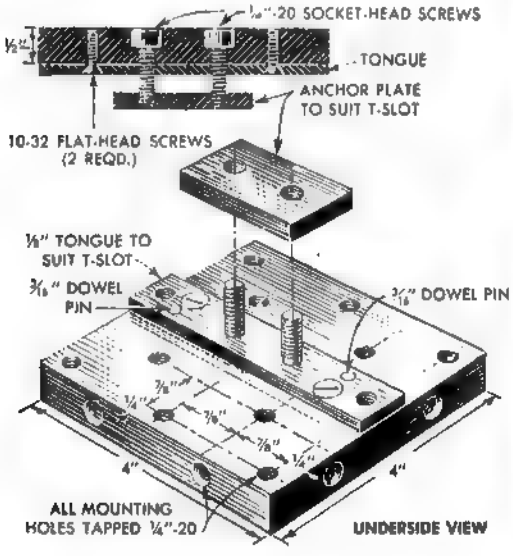
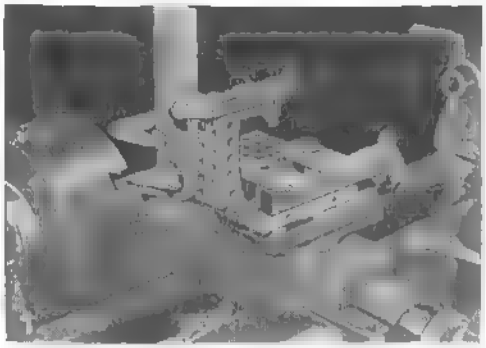


Plate permits milling keyways in round or bar stock



Reaming and boring is done with aid of angle plate

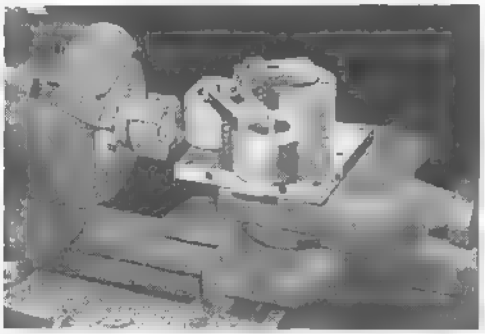
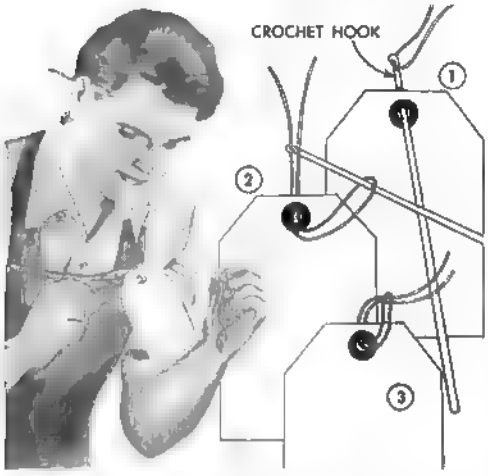


Plate speeds machining of work in multiple setups

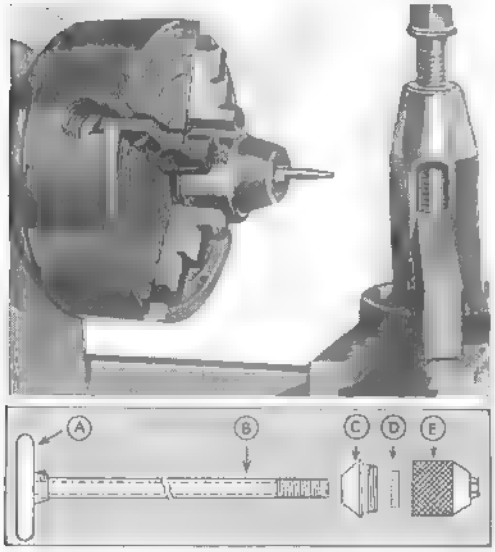
Shipping Tags Strung Quickly By Using a Crochet Hook



Shipping tags of the type having strings inserted through holes in the tags can be strung quickly and easily if an ordinary crochet hook is used. The string is doubled and the crochet hook is inserted through the hole to engage the loop, which is pulled through the hole as in Fig. 1. The hook then is advanced through the loop to catch the strands, Fig. 2, and pulled back, bringing these through the loop to form a simple hitch as in Fig. 3.

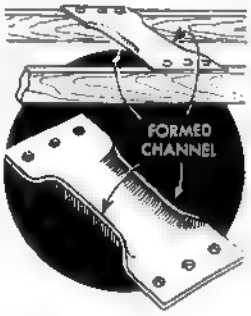
Lathe Collet for Small Work Made From Drill Chuck

Lacking a collet attachment for his lathe, one machinist made a satisfactory substitute by taking a ½-in. drill chuck and altering it to take stock of any diameter up to ⅜ in. One advantage of this chuck is that once it has been centered in the lathe, any number of pieces can be machined without further centering. When making the attachment, drill a ⅜-in. hole in disk D to allow long work to pass through the chuck E. One end of tubing B then is threaded to fit piece C of the chuck and the other end is threaded for handwheel A.



Sheet-Metal Braces Strengthened By Forming Channels

A flat sheet-metal brace can be made more rigid by hammering down the free edges so they are at right angles to the brace. In effect, this forms a channel that will be much stronger than the flat piece of metal.



Small Bottle Is Used as Trowel

When laying a cement floor in a basement, you can use a small round bottle instead of a trowel. The bottle is used to form neat concave corners where the floor joins the wall.

Brush Cleans Rubber Stamps

Rubber stamps can be freed of thickened ink and other clogging material by being passed lightly over the bristles of a small scrub brush screwed to a workbench or wall within easy reach.

Corroded Brake Cylinder Polished With Steel Wool on Rod

If no hone is available for dressing down the interior of a hydraulic-brake cylinder that has become corroded, a length of metal rod and a wad of fine steel wool will do the work. The rod should be of a diameter to fit into the chuck of a hand drill, and is slotted at one end for a short distance. The steel wool is wrapped around this end and engaged in the slot, after which the rod is chucked in the drill and rotated inside the cylinder to polish it. Check the work at intervals to avoid scoring the wall.

CARS NEED CARE

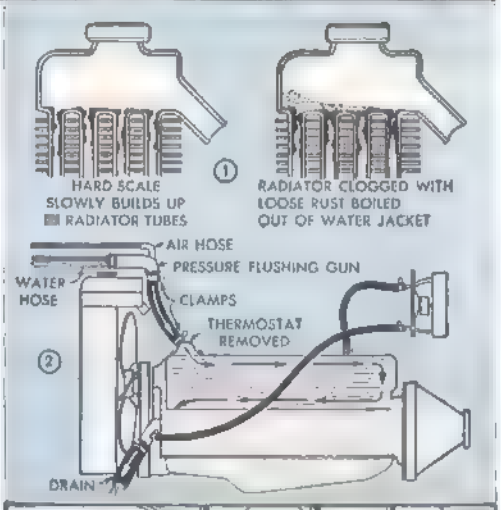
To Keep 'em Rolling

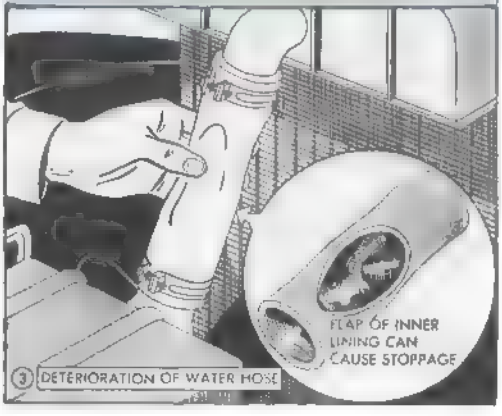
Costly repairs due to engine overheating can be avoided by thoroughly cleaning and flushing cooling system periodically

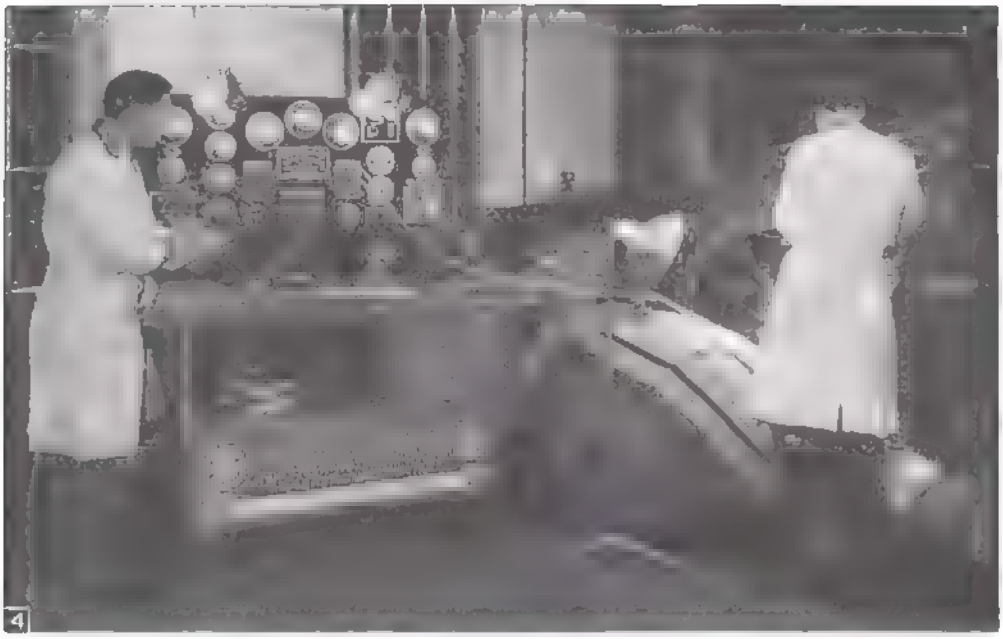
By Phil Ruskin

KEEPING your car on the road does not call for a continuous process of tinkering with the mechanical parts. Instead it's regular periodic attention to simple details that keeps a car going year after year. Many vital mechanical parts never really wear out. They deteriorate simply because of neglect and inattention to a regular servicing schedule. The cooling system is a good example. With proper care, it will last as long as the car, but if it is not serviced regularly, it can be a constant source of trouble. Figs. 1 and 3 show why it is necessary to do a thorough job of flushing out the system periodically and why the hose should be carefully checked on schedule. Even though you use soft water or a rust inhibitor each time the cooling solution is changed, considerable debris collects in the cooling spaces of the engine block. This should be cleaned out at least twice a year with a flushing gun as in Fig. 2. Reverse flush the radiator at the same time to remove loose rust and other particles that may collect in the top tank, Fig. 1. Hard scale on the tubes and in the engine block can be removed only with special cleaners which dissolve these deposits. Follow the manufacturer's directions when using any of these preparations.

Another important check easily made periodically by the car owner, is that pictured in Fig. 5. The instruction book that







An accurate check with scientific motor-testing equipment takes the guesswork out of tuning up an engine

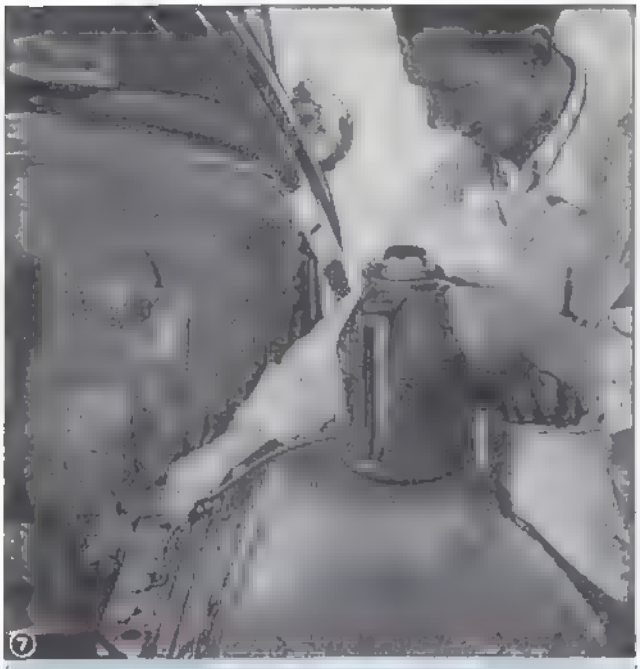
comes with the car usually specifies a fan-belt deflection, or slack, ranging from ½ to ¾ in. Measure this with a ruler and straightedge as shown and adjust to the specified tension. When you put on a new fan belt it is particularly important to check this adjustment often, as a new belt will slacken with use.

Periodic instrument checks at your local garage, Fig. 4, will disclose any faults developing in the fuel and ignition systems, which then can be remedied easily before they create serious trouble. When the engine gets sluggish, lacks pick-up or runs roughly, its poor performance usually indicates that either the fuel or ignition system, or possibly both, are at fault. Other probable causes should not be overlooked, however. Faulty valves or a clogged cooling system can cause somewhat similar symptoms. If sluggish engine performance indicates poor compression, first thought usually is given the piston rings and the condition of the pistons and

A fan belt that's too tight will squeal and wear rapidly. Adjust to produce about ½ to ¾-in. slack

Engine compression can be improved by replacing worn gaskets when plugs are removed for cleaning

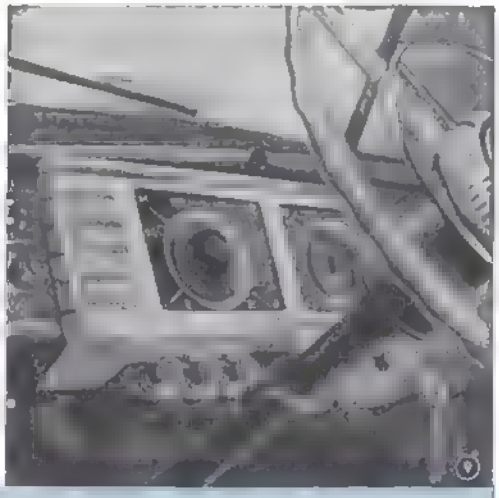
cylinders. However, there is another possible cause, not at all common, but it should be kept in mind and always checked before dismantling the engine. In older cars, where spark plugs have been removed several times for cleaning and checking the spacing of the points, the copper plug gaskets, Fig. 6, are frequently flattened or roughened so that they no longer provide a tight seal. This can cause a slight compression leak which is difficult to detect. Several leaky plug gaskets, even if each leak is only very slight, can materially affect engine performance. A good insurance against trouble from this source is taking care to tighten the plugs uniformly after removal, but avoid drawing them too tight. Before screwing the plug in, see that there is no grit or other hard substance on the gasket. The spark gap should be adjusted to the setting specified by the manufacturer. The slow burning away of the bendable point reduces its diameter and changes the gap correspondingly. Because of this, the spark gap in each plug should be checked regularly. Use a feeler gauge or a spark-plug tool made especially for the purpose. Keep close check on the ignition wires in an older car, Fig. 8. The insulation usually breaks first at the bends and where the wires pass close to the engine block. When small cracks show at these points the wires should be replaced. If this is not done, current may leak to the block and "short" a plug.



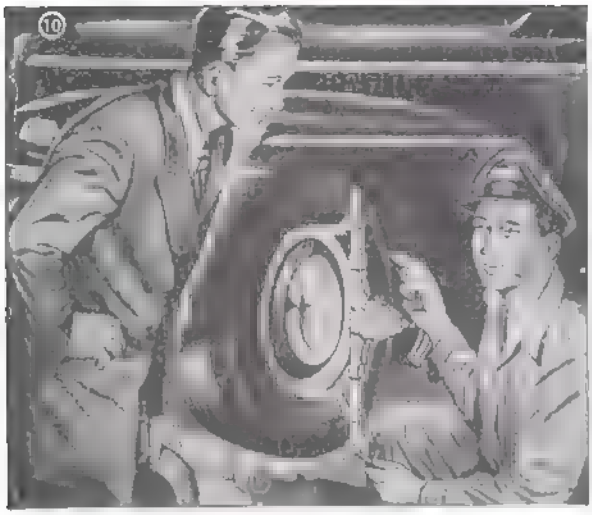
Keep the water level in your battery about ¼ in. above the top of the plates and use only pure distilled water. Do not overfill

With regular care a battery will last for at least two years, more often longer. Watch for corrosion around the terminals, on the clamp end of the ground strap and

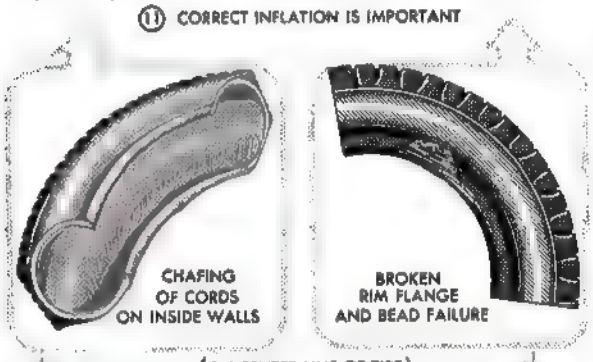
Ignition wires should be examined periodically to see that there are no bare or frayed spots

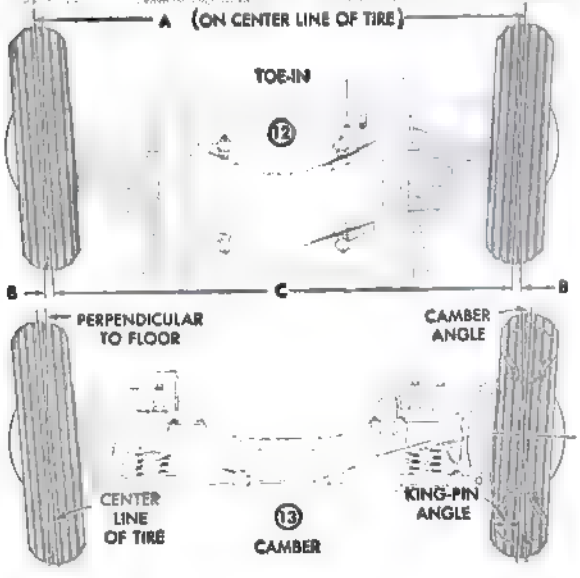


Keep all the instrument-panel gauges and switches in good working condition for safety and economy



(11) CORRECT INFLATION IS IMPORTANT



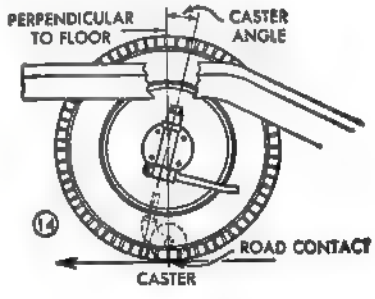


(12)

(13) CAMBER

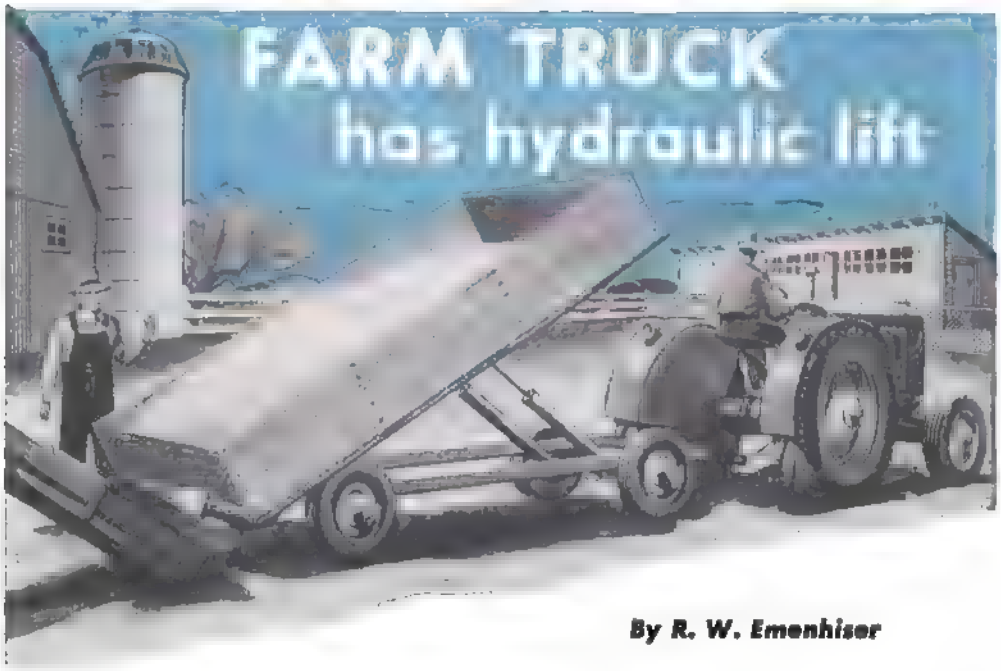
on the cradle. Wash this off with a moderately strong soda water, rinse with clear water and wipe dry. Then coat all the affected parts with petroleum jelly. Be sure that the battery is supported firmly in the cradle so that it cannot shift. Looseness of the lead clamps on the terminals or a faulty connection of the ground strap to the engine block or car frame may cause hard starting and perhaps engine failure on the road. Keep the battery solution at the correct level by adding distilled water at regular intervals, Fig. 7. Don't add water during cold weather without driving the car immediately. If the car stands idle the fresh water may freeze and crack the battery case. On older cars not fitted with voltage regulators the charging rate should be watched carefully. Adjust the rate so that the battery is kept fully charged at all times. Check occasionally with a hydrometer. Keep all gauges and switches on the instrument panel, Fig. 9, in good working order, particularly the ammeter and oil-pressure gauge.

If you hit a bad bump or nudge a high curb too hard with one wheel while parking, it's a good idea to have the wheel alignment checked immediately. The alignment check should always include toe-in, camber and caster of the front wheels, Figs. 10, 12, 13 and 14. Toe-in slightly out, too little camber or incorrect caster angle can cause undue wear on the tires and hard steering. When adjusting any of these wheel angles, follow the recommendations of the car manufacturer. Under or over inflation can cut up tires quickly even when driving is done at moderate speeds on good roads. Fig. 11 shows why, and how.



(14)

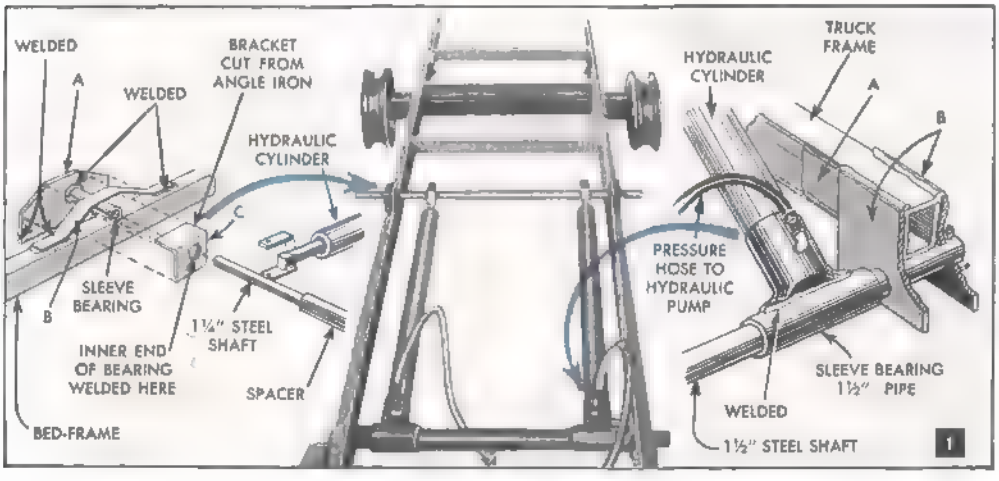
FARM TRUCK has hydraulic lift

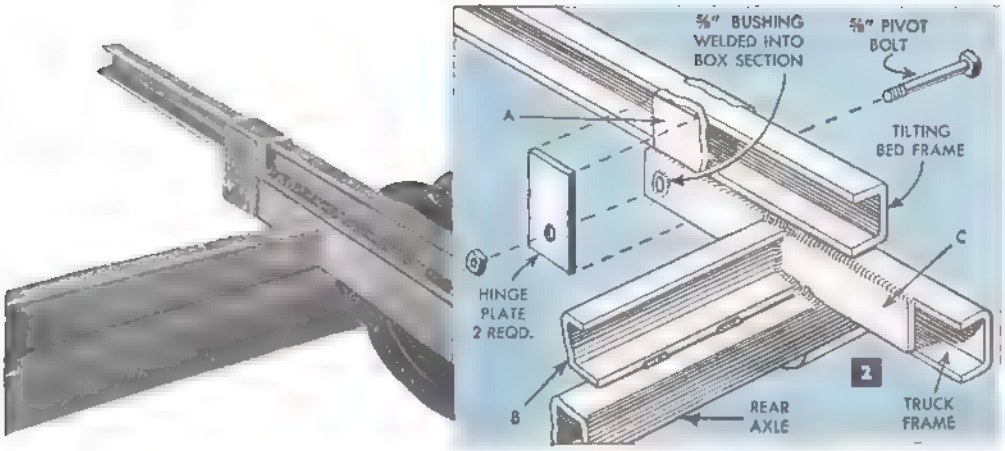


By R. W. Emenhiser

WHY SPEND TIME and hard labor to unload grain, cobs, sand or gravel from a tractor-drawn trailer truck with a hand scoop when it is so easy and inexpensive to put a hydraulic lift on the trailer to dump the load just where you want it? This type of lift gives positive control of the height and rate of lift, which is important when dumping grain into an elevator hopper or when spreading a load in a grading, filling or field-leveling operation.

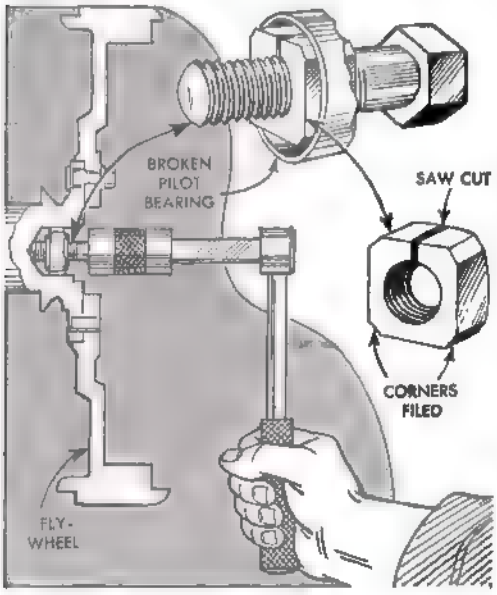
All parts of the trailer truck pictured and detailed in Figs. 1 and 2 are stock items readily obtainable at nominal cost. Standard trailer-truck axles are used. Both the subframe, or truck frame, and the tilting frame are made from steel channels, and the necessary reinforcing gussets and other small parts of each assembly are cut from heavy sheet steel. The





tilting bed frame pivots on the truck frame at a point just back of the rear axle, as shown in Fig. 2. The bed frame should be raised about 1 in. above the truck frame, or the truck frame cut at an angle of 45 deg., to allow the bed frame to tilt. In addition to the two channels on each side, this pivot assembly consists of the parts A, B and C welded in the positions indicated. Note from the detail that the truck-frame cross member, B, is welded to the box-section axle. Of course, the truck frame can be bolted to the front and rear axle if desired. Hydraulic cylinders are of the type used with tractor scoops, but any similar cylinders can be used. The lower ends of the cylinders pivot on a shaft mounted on the truck frame by means of the parts A and B shown in the right-hand detail, Fig. 1. The hydraulic plungers bear against a shaft pivoting in sleeve bearings mounted on the tilting frame as in the left-hand detail, Fig. 1. The sheet-metal parts A, B and C are welded to the frame in the positions shown to form the bearings. In making up the truck frame, be sure that the front wheels have clearance for turning. Determine this before welding the box-section cross braces to stiffen the tilting frame as shown in Fig. 1. Use a pipe tee and hydraulic unions to connect the two lines from the hydraulic cylinders to a single line running to the hydraulic pump on the tractor. The bed is of usual construction, 7-ft. wide, supported on hardwood sills bolted to the tilting frame.

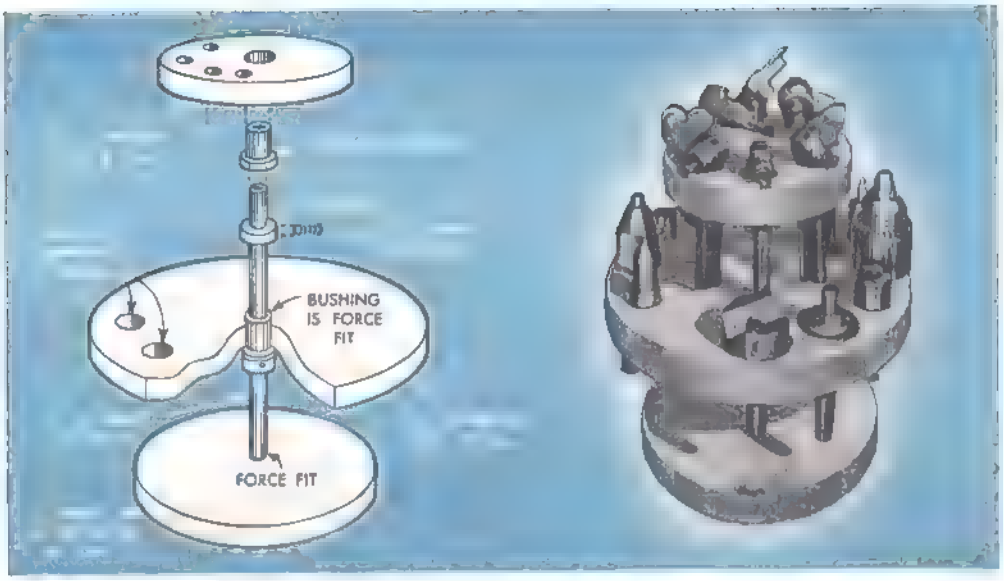
Race of Broken Pilot Bearing Removed Easily With Machine Bolt



Faced with the problem of extracting the outer race of a broken pilot bearing in an auto-engine flywheel, I hit upon a simple way of removing it with a machine bolt. First, I selected a short bolt having a nut which measured slightly more from corner to corner than the inside diameter of the race. Then I slotted the edge of it, as shown, and squeezed the nut to close the slot. Next, I filed down each corner at a slight backward taper so that the nut just fitted inside the bearing race. After this, I expanded the nut in the race by opening the slot with a cold chisel and turned the bolt into the nut. When the end of the bolt made contact with the crankshaft, continued turning with a wrench forced out the race.—T. O. Carlsson, Chicago.

Flat belts and V-belts used on equipment in the shop, home or on the farm, may be cleaned safely and efficiently by using carbon tetrachloride. This liquid is noninflammable and it will not injure the belt.

Rotating Tool Stand Holds Lathe Accessories

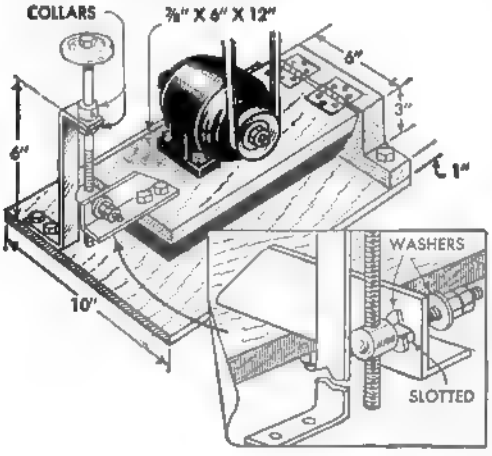


When work at a metal-turning lathe requires the use of a number of accessories on the same job, a rotating tool stand like this one is a timesaver. It also keeps the tools in order when they are not in use, preventing them from getting nicked or otherwise damaged by handling or storing in a drawer. Three plywood disks, a couple of flanged bushings and a short length of steel shafting are the principal parts of the stand and it takes only a few minutes to assemble them. Tools fit into holes drilled through the wooden shelves, a special hole being drilled to accommodate each tool. Note that tools in the lower shelf can be removed and replaced without disturbing those in the upper shelf. Arrangement and size of the holes must be worked out by measurement of the tools. Each shelf is center-drilled to take a flanged bronze bushing in a force fit. The bushings bear on collars fastened to the shaft with setscrews. The hole in the base for the shaft should be drilled slightly undersize so that the shaft will be a tight, force fit.

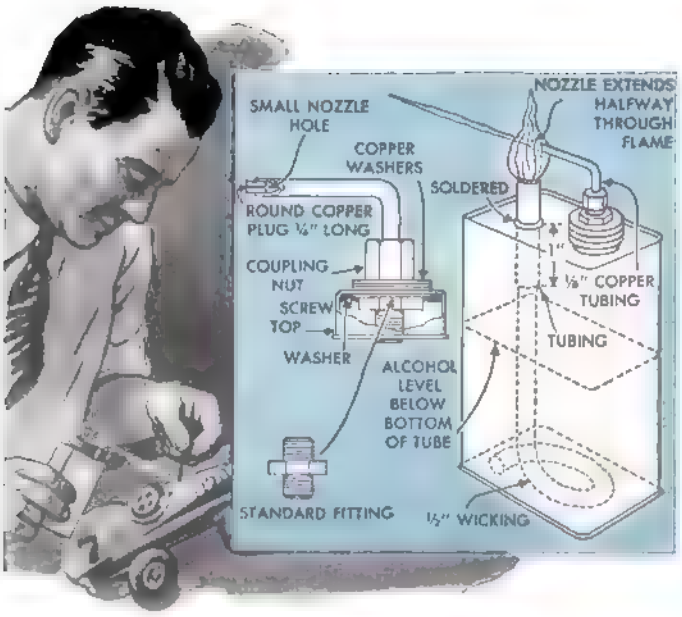
W. S. Kals, Vancouver, Can.

Hinged Motor Mount Has Handwheel for Belt-Tension Adjustment

Designed for use where a power tool is driven from below, this hinged motor mount provides for uniform belt tension without imposing the weight of the motor directly on the bearings. Slack in the belt is taken up by turning a handwheel. This raises or lowers a hinged shelf to which the motor is fastened. The drawing shows how the device is made. The adjusting mechanism consists of a threaded shaft supported vertically by a flat-iron bracket and two collars. The shaft passes through a tapped hole in the head of a specially turned bolt and the end of the shaft rests on the bottom board. The turned bolt is supported by a piece of angle iron which is bolted to the end of the motor shelf. Two nuts on the bolt permit it to be tightened sufficiently to provide a sliding fit in the slot in the angle-iron support. Note that the rear edge of the motor shelf is cut at an angle to allow it to be lowered.



¶To prevent unraveling of rope ends, dip them in varnish or shellac before using.

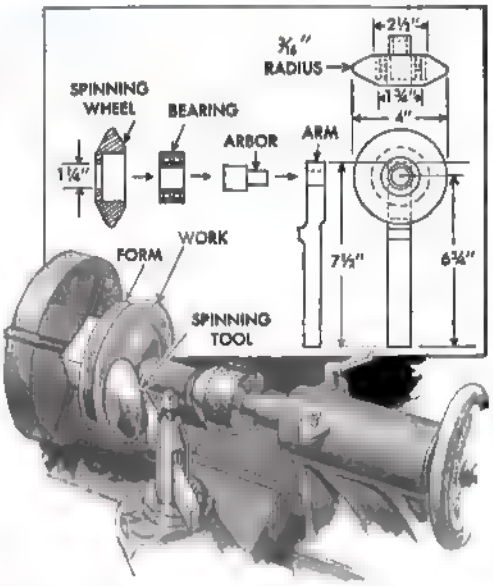


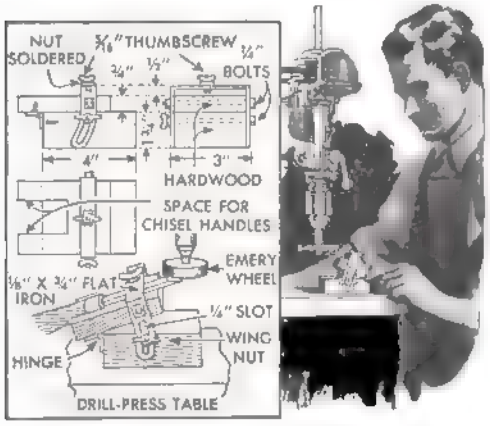
Alcohol Torch Made From Scrap Parts

Producing a hot, needle-point flame, this little blowtorch, which generates pressure by the expansion of alcohol vapor, will be found handy for many small soldering and light brazing jobs. The tank is a lighter-fluid can, and the nozzle, consisting of a length of ⅛-in. seamless tubing, is attached to the screw-top cap of the tank as shown. The wick is fed through a ½-in. tube which is soldered in the top of the can to extend 1 in. inside. Note that the hole in the nozzle must be very small.

Nonfriction Spinning Tool

Designed to spin with the work, this ball-bearing spinning tool offers several worthwhile advantages; it eliminates tool marks, keeps friction heat at a minimum and produces a finer finish on the metal being spun. The tool is used in conjunction with the compound rest of a metal-turning lathe and is manipulated by the cross and carriage feeds of the lathe. All parts of the tool are dimensioned in the drawing. It may be necessary to alter the size of the arm to suit the tool post at hand, and also the size of the wheel to fit the bearing. The wheel should be casehardened, and the arbor a light press fit in both arm and bearing. Peening the ends of the arbor locks the wheel to the arm. In using the tool, it is advisable to coat the work with a lubricant such as lard oil, to reduce friction and produce a smooth job.





Adjustable Jig Positions Chisel For Grinding in Drill Press

With this jig, chisels, plane irons and other flat-bladed tools are held at the correct angle for sharpening in a drill press. The tilting top and base are cut as shown in the detail, the top being notched for chisel handles. Angle adjustment is provided by a metal strap bolted to the top and slotted for bolts and wing nuts in the base. Space is left between the strap and the tilting top to allow for insertion of the tool blade. A thumbscrew holds the tool.

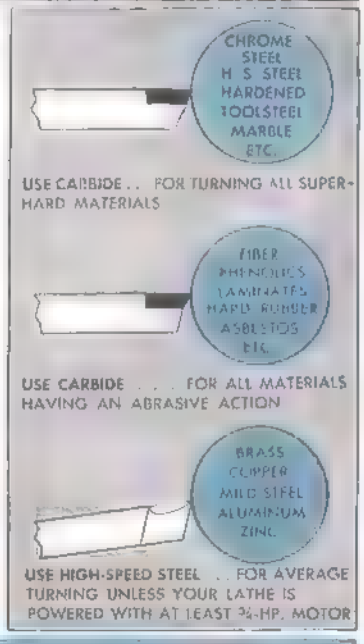
Gust M. Larson, Cloquet, Minn.

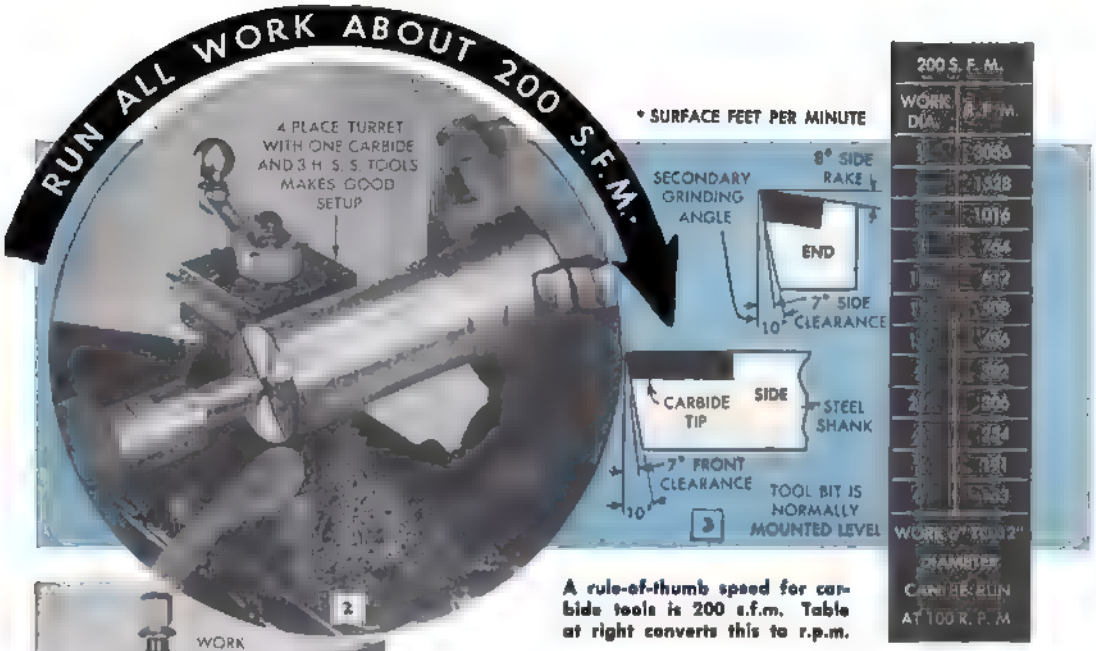
Turn it with Carbide Tools

Photo courtesy Carbotoy Co.

IF YOU have had the edge of a high-speed bit fold up when making the first "skin" cut on cast iron, you'll appreciate the way a carbide-tipped tool peels off the metal. This high-production cutting tool of industry can be put to work in the small machine shop as well as the home workshop. For besides being used in a tool post, it can be used freehand like a wood-turning chisel, Fig. 9, to turn brass, aluminum and plastics at wood-lathe speeds. Once ground and sharpened, carbide tools will stay sharp longer than any other cutting tool. They require only light honing at long intervals with a silicon-carbide stone to maintain the edge. Tools tipped with carbide can be purchased, or you can assemble chisels as shown in Figs. 10 and 11.

What is cemented carbide? The sketch at the bottom of the page explains cemented tungsten carbide graphically. The full-name description often is shortened to just "carbide." Cobalt is the bonding or cementing agent that binds the particles of tungsten carbide into a compact mass, which closely resembles polished steel. This metal is super hard—it scratches glass, Fig. 1, and it will cut the hardest file. Like all very hard materials, it tends to be brittle and will not stand excessive shock loads. By adding a greater proportion of cobalt, hardness is reduced slightly and toughness is increased. There are two main groups of carbide tools: The straight tungsten carbides, as already described and illustrated, and the combined





A rule-of-thumb speed for carbide tools is 200 s.f.m. Table at right converts this to r.p.m.

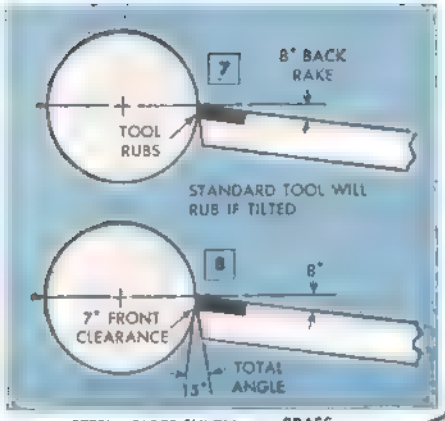
carbides, which are tungsten carbide with titanium or tantalum added. The straight tungsten carbides are used for turning all materials except steel; the combined carbides are used for steel only. The difference is that steel tends to stick or build up on straight tungsten carbide, and the addition of tantalum or titanium helps to overcome this fault. However, for light turning, any kind of carbide tool can be used successfully on any type of material.

What can carbide do? Being extremely hard, carbide turns all materials at high speeds not possible with other cutting tools. Consider a sample job: In turning 1-in. mild steel it is an easy job for carbide to turn this at 300 ft. per minute with a .010 feed and ⅛-in. depth of cut. In other words, with the lathe running at 1150 r.p.m. the tool will peel off 4½ cubic inches of metal per minute. But such a heavy cut requires a lathe powered with a 2½-hp. motor. As the average home-workshop lathe is powered with a fractional-horsepower motor, it is apparent that the full cutting capacity of carbide cannot be utilized as even a high-speed steel bit will tax the capacity of the motor.

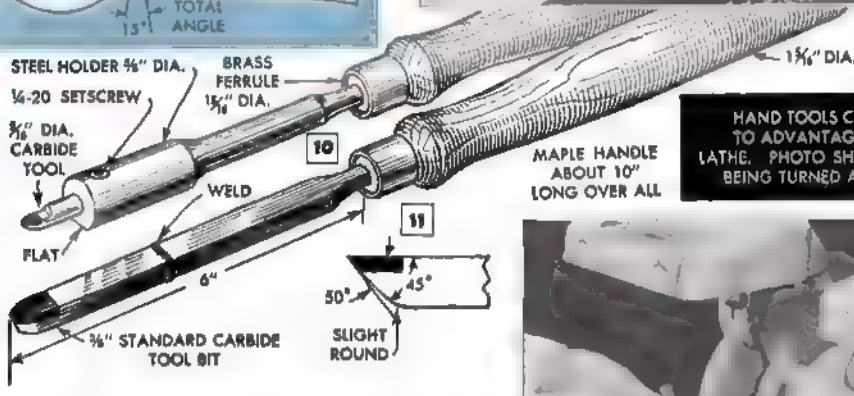
However, there is another side to the picture. Very often you will encounter a hard piece of steel which resists turning with high-speed bits. A good example of this is where a broken high-speed drill with Morse shank is turned down to make some other tool. That's where you can use carbide. Again, take a seemingly simple job like turning a ring in phenolic plastic. Most of these plastics are filled with metal, asbestos, wood flour or other material, all very abrasive and quick to turn the edge of carbon or high-speed steel tools. Here, again, the carbide tool does the job perfectly.

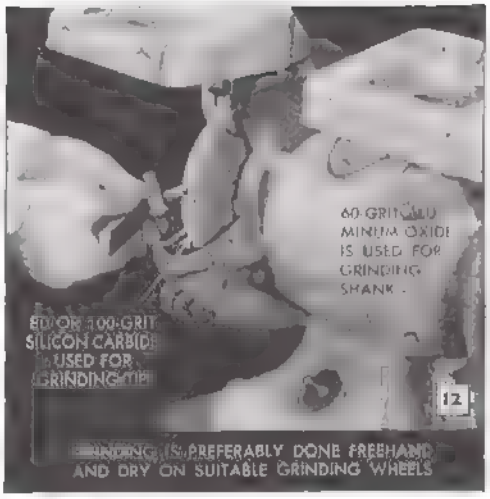
Carbide is excellent, too, for turning cast iron. Cast iron does not offer the resistance of steel, hence a fair bite can be made with the work running at 200 s.f.m.

How is carbide used? Just forget you have anything special in the way of a tool bit and use carbide the same as you would high-speed steel. Assuming your



HAND TOOLS CAN BE USED TO ADVANTAGE ON SPEED LATHE. PHOTO SHOWS ALUMINUM BEING TURNED AT 900 R. P. M.





power is no greater than a ½-hp. motor, it is impossible to overtax carbide with any combination of speed and feed which the motor will pull. A good rule is, "200 feet per minute," and the table adjacent to Fig. 3 converts this to r.p.m. Ready-sharpened tool bits, available in various sizes and shapes, are intended to be mounted on-center and horizontal as shown in Fig. 3. Figs. 2, 4, 5 and 6 show various mountings. Although industry uses the standard shape, Fig. 4, best results on light equipment are obtained if tool-bit angles closely pattern those of high-speed steel. A good setup is shown in Fig. 7 where the tool is given 8 degrees back rake by the angle of the tool holder. In this case, it is necessary to provide more front clearance, as can be seen in Fig. 8.

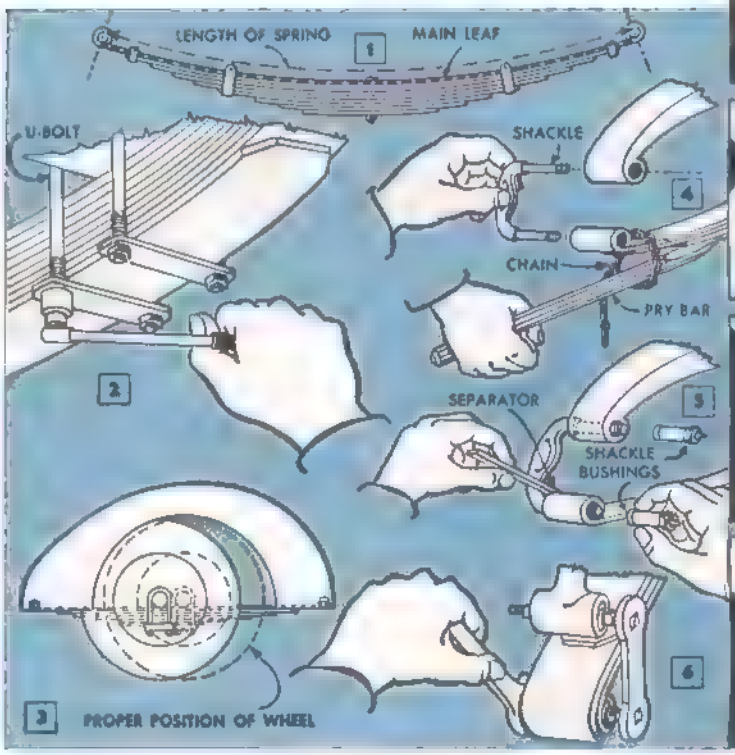
How is carbide ground? Use a silicon-carbide wheel for grinding the tip, Fig. 12, and forget anything you may have heard about carbide being tough to grind. True, it is a super-hard metal and grinds slowly, but if you keep the tool moving to grind off small facets, the carbide wheel does the trick quickly. Double angles are commonly used in grinding carbide bits. Grind the tip at the required angle and then back off the metal shank an extra two or three degrees. With this system, light sharpening can be done on the silicon-carbide wheel without running into the shank. Use an aluminum-oxide wheel if it is necessary to undercut or grind the shank.

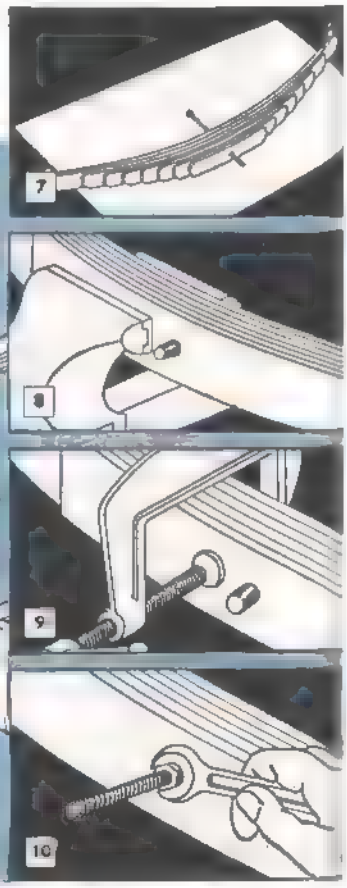
Hand tools: Carbide hand tools do excellent work in turning brass, aluminum and plastics, as in Fig. 9, and can be purchased ready-made in square and round-nose patterns. It is also practical to make your own tools from standard tool bits, as shown in Figs. 10 and 11. Once ground and sharpened, these turning tools will stay sharp indefinitely and require only light honing on a silicon-carbide oilstone.

INSTALLING CAR SPRINGS

ALTHOUGH repairing or replacing a broken or damaged spring is a simple job, waiting for your turn to have it repaired may take several days. Rather than have your car or light truck out of service for this length of time, why not install the spring yourself? Figs. 1 to 6 inclusive detail the usual procedure in removing a spring. If the spring is to be replaced, or if it is necessary to replace the main leaf, it's important to know the exact length. Fig. 1 shows how to measure it correctly. Before loosening any of the parts or jacking up the car, block both the front and rear wheels securely. Use a roll-away jack if the work is done on a level floor. Assuming that a rear spring is to be removed, place the jack against the frame about 6 in. ahead of the spring. Raise the car until the spring assumes the normal "free" arch when tension due to weight of the car is removed. Wheels should not leave the floor. Block up under the frame at a point near the jack. Disconnect the shock absorber if it interferes. Then remove the U-bolts, Fig. 2, and the front and rear shackle pins to free the eyes of the spring. On some late-model cars, such as Nash and Hudson, the emergency-brake cable is clipped onto the spring. In this case it will be necessary to cut the clip bolt and replace it with a new one when the spring is installed.

Installing a spring after servicing or repairing it is just as easy as the removal if the correct procedure is followed. Figs. 7 to 10 inclusive detail the first steps. Arrange the spring leaves on a table according to size and length. If the center holes of the leaves are not equally distant from the ends, be sure before installing the center bolt that the long ends face the same way. Align the leaves with a straight pin or rod of the same diameter as the bolt, Fig. 7. Don't attempt to draw up the loose leaves with the center bolt; you are very likely to strip the threads. With the pin in place, tighten the spring in a heavy vise as in Fig. 8, or with C-clamps as in Fig. 9. Remove the pin and install the



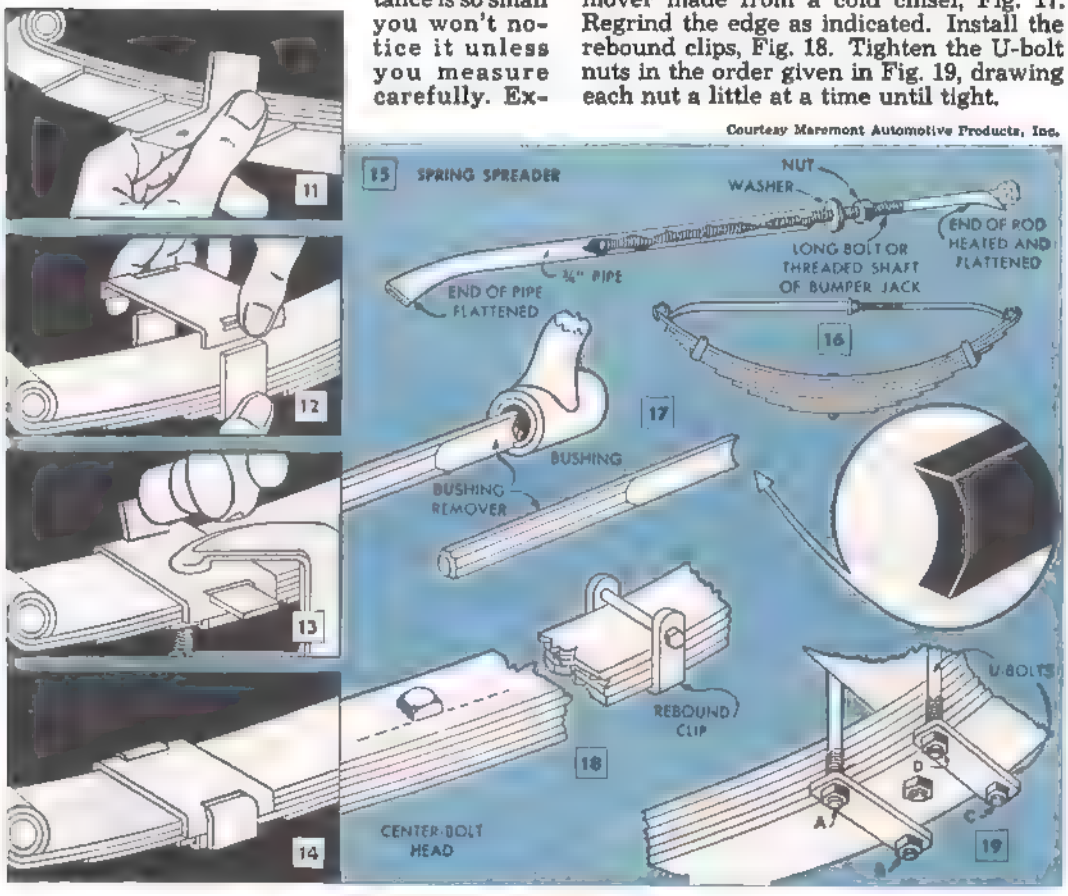


bolt as in Fig. 10. On overslung springs, the head of the center bolt should be on the short-plate side of the spring, but on underslung springs the head of the bolt should bear on the main leaf. Any projection of a new bolt beyond the nut after tightening, Fig. 10, should be cut off. Align the center-bolt head as in Fig. 18. The spring clips may now be installed, Figs. 11 to 14 inclusive. Place the U portion of the clip in proper position, with the nib fitting into the rivet hole. Apply the saddle so that the ends of the lower plate extend through the upper openings. Hammer down both ends firmly. Remove the clamps and the job is done.

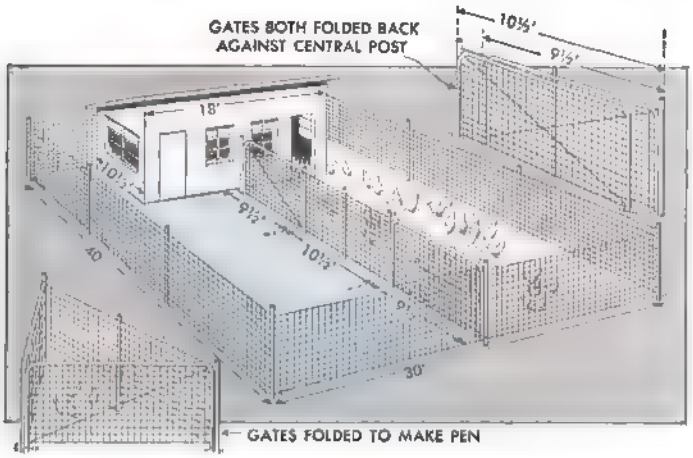
When placing the spring back in position, be sure that you have it "right end to" so the car or truck axle will be in the correct position, Fig. 3. If the center bolt is in the center of the spring, and the eyes or bushings are the same at both ends, then there's nothing to worry about. But one must watch for springs with different eyes or bushings which must be matched with the shackles, to get the right end forward. Also some springs are made with the center bolt off-center. Sometimes this off-center distance is so small you won't notice it unless you measure carefully. Except in a few instances, the short end of such a spring is always installed toward the front. Generally, the swinging shackle has ample freedom of movement so that assembly is easy. But for cars with U-shackles a separator must be used to keep the eye of the spring in position, Fig. 5. Also, it sometimes is necessary to place a jack under the spring near the center bolt and spread or flatten the spring sufficiently to bring the eye within reach of the shackle. Then with a pry bar and chain arranged as in Fig. 4 the spring can be brought into position so that the shackle will slip in place. If shackles are of the type shown in Fig. 6, place the shackle link on the stud of the perch bushing and line up with the spring-bushing stud. With a wrench turn the spring stud so that the opening in the link will fit over the squared section of the stud. Then turn on the nuts, tighten, and install cotter pins.

On Ford, Lincoln and Studebaker cars it is necessary to use a spring spreader made from a length of pipe and a threaded rod as in Fig. 16. When removing worn or defective perch bushings on Ford, Mercury and Lincoln cars use a bushing remover made from a cold chisel, Fig. 17. Regrind the edge as indicated. Install the rebound clips, Fig. 18. Tighten the U-bolt nuts in the order given in Fig. 19, drawing each nut a little at a time until tight.

Courtesy Maremont Automotive Products, Inc.



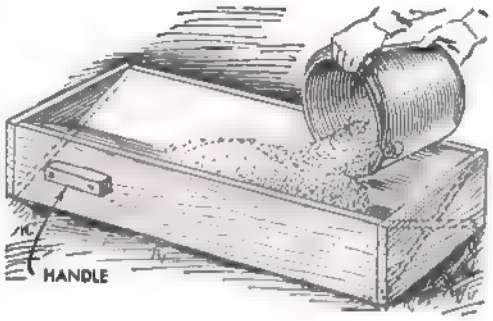
Fence Divides Poultry Pen to Supply Green Food



Keeping a flock penned alternately on one side of a divided yard while feed is growing in the other, assures the chickens fresh "greens" all through the summer months. Note that the gates of the fence also fold to form a small culling pen. By using dimensions proportionate to those given in the drawing for the gate section, a similar fence may be built in a yard of almost any size.—D. Jay Rhoades, Omaha, Nebr.

Reversible Feeding Trough Keeps One Side Free of Ice and Snow

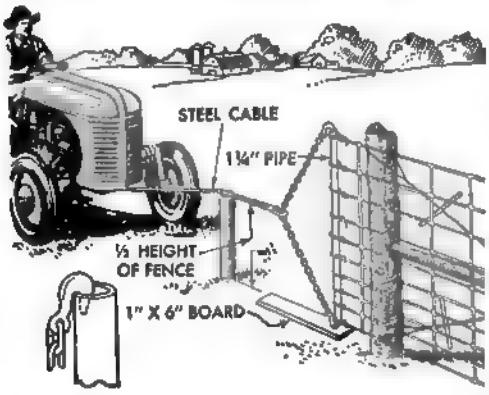
You can solve the annoying problem of ice and snow accumulating in the feed trough during the winter time, by building this reversible one that merely is turned over when the top side is not usable. Unless the weather is extremely cold, the ice usually will melt from the underside leaving it ready for use at the next feeding. Build the trough with a double-V bottom as shown, using one board wide enough to extend from corner to corner diagonally and two narrower boards nailed in place to form a V-shape on each side.



Pipe-and-Chain Rigging Employs Tractor to Stretch Wire Fencing

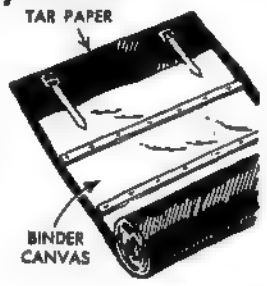
Having to erect a woven-wire fence recently without help, I was able to do the job quickly and easily by putting the tractor to work to do the stretching. This was done by first twisting the ends of the fencing around a length of pipe and resting it on a board. Then I hooked a strong chain into the ends of the pipe and attached a steel tow cable to it in the manner shown. With the tractor facing the fence, I backed it away slowly until the wire was taut, and set the brakes. Then all I had to do was drive the staples. Note that the removable post supporting the tow cable must be about half the height of the fence to produce an even pull at both top and bottom of the fencing.

L. A. Potts, Panama City, Fla.



Tar Paper Protects Binder Canvas From Damage by Rodents

An effective way to keep rats and mice from damaging binder canvas in storage is to wrap it in a strip of tar paper. Use a strip longer and wider than the canvas and roll it as shown.



OFFSET BORING HEAD

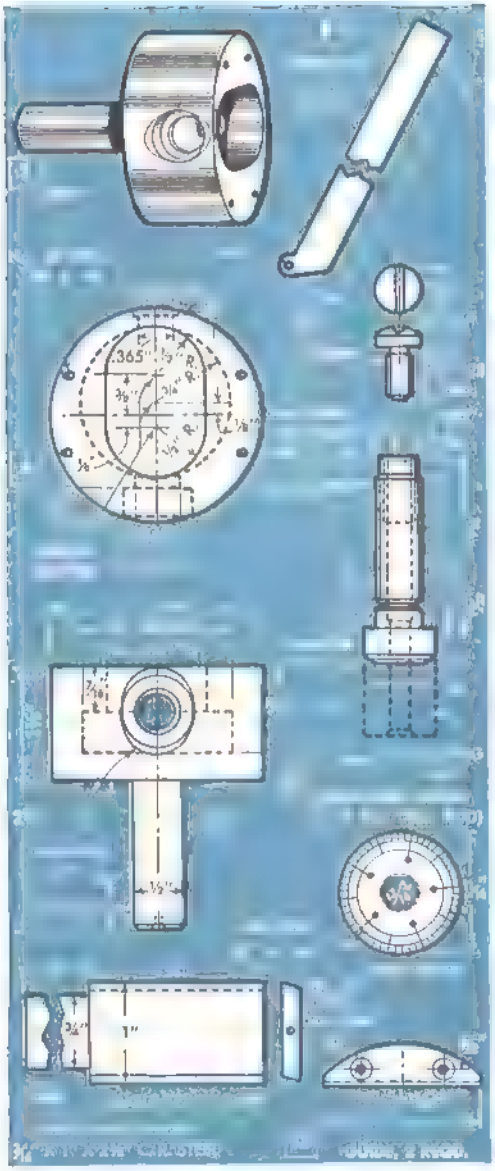
By E. W. Holt

AN ADJUSTABLE offset boring head is an attachment that greatly increases the range of work that can be done on a small metal lathe or a drill press. Used in a drill press, it permits boring holes of greater size than are possible with common-size drill bits. When chucked in a lathe, the offset head will handle many boring jobs otherwise beyond the swing of the lathe. Also, where a lathe is not equipped with a taper attachment, the boring head can be used in the tailstock spindle for taper turning, thereby eliminating the time-consuming operation of resetting the tailstock.

Beginning with the collet, Fig. 1, turn a piece of 2$^{9}/_{16}$-in. stock to 2$^{1}/_{32}$ in. in dia. and face both ends. Scribe a center line completely around the work and center-drill two offset center marks on each end as indicated in Fig. 4. Scribed lines on metal will stand out more clearly if the work is coated with a saturated solution of sulphate crystals and water. After turning the $^{7}/_{16}$-in. groove in the collet, Fig. 3, A, mount the work first on one offset center and then the other to turn the bottom flange elliptical shape, as in Fig. 5. Set aside the collet for the time being.

Next, center-drill 2¼-in. stock for the body, Fig. 7, and turn it down to 2⅛ in. in dia. Turn the spindle to ½ in. and face the large end. If a tapered spindle is preferred, it should be made somewhat shorter than the standard length for a Morse taper and the end tapped for a draw-in rod. A threaded plug will bring it up to the standard length required for ejection

Mount collet off center to turn elliptical flange



from the tailstock spindle. When this is done, scribe a center line across the face and along both sides. Then lay out the elongated hole and the two outer offset center marks, Fig. 8. After center-drilling the offset marks, mount the body in a four-jaw chuck and scribe index marks on two opposite jaws to align with the marks on the side of the body. With the work mounted off center, using the ½-in. radius, run up the tailstock center to locate and hold the turning while chucking. Use a band of copper or other thin stock to protect the work from jaw marks and tighten the chuck so that the scribed lines (witness marks) on both chuck and work coincide. Bore a hole in the face 1 in. in dia. and $1\frac{3}{16}$ in. deep. Then rechuck the work on the other offset center and bore another hole of the same size and depth. This will produce two overlapping holes which are formed into one elongated hole by filing away the remaining waste. Now locate the middle offset center (¾-in. radius). The work is mounted on this center and the bottom of the hole is undercut on two sides, as indicated by the dotted lines in Figs. 8 and 9. The boring-bar cutter, used to form the undercut, should not be more than ⅛ in. wide and the recess formed by undercutting the work should fit the elliptical end of the collet in a snug, twist fit.

Next, a hole is made in the thick side of the body and the collet for an adjusting screw, Fig. 12. To bore this hole, place the collet inside the body and align the center lines of each one. Then, using a V-block, clamp the work to an angle plate. Next, clamp the whole assembly to a lathe faceplate, Fig. 14. Check to see that the work is centered by running up the tailstock center and balance the setup with a counterweight. Now, drill a ⅜-in. hole through the thick side of the body and completely through the shank of the collet. Next, bore and ream a .365-in. hole through the opposite side of the body. This hole provides a bearing for the end of the adjusting screw. The ⅜-in. hole in the thick side of the body is reamed to $\frac{7}{16}$ in., after which the hole is counterbored $1\frac{1}{16}$ in. for a depth of $\frac{5}{16}$ in. to provide a recess for the head of the adjusting screw. Then the work is remounted and the .365-in. hole is counterbored. Finish by removing the collet and tapping the hole $\frac{7}{16}$ in.-20.

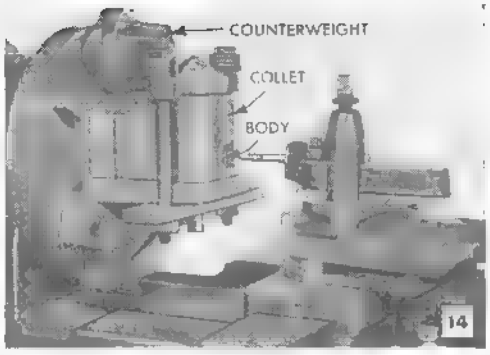
The adjusting screw, Fig. 12, is drilled through its center, one end being tapped for a threaded retaining screw, detailed in Fig. 11. The shank of the adjusting screw is threaded to fit snugly in the tapped hole in the collet. Next, a midline is scribed on the chamfered edge of the adjusting screw and the $\frac{5}{16}$-in. hole in the screwhead is filed to take a socket-head setscrew wrench.

The graduations on the chamfered edge of the head of the adjusting screw are scribed in the following manner: Draw a 6-in. circle on sheet metal or heavy paper. Mark five equal spaces around the circle and divide each space into ten equal parts. Draw two additional circles of any radius and lay out the graduations as shown in the end detail below Fig. 12. Next, make the template, Fig. 6, and turn a plug for a push fit in the hexagon hole. A 1/16-in. pivot pin in one end of the template fits a hole in the plug. Fasten the paper to a board and drill a 7/16-in. hole through the board at the center of the circle. Insert the adjusting screw and, with the template pivoted on the pin, proceed around the circle using a sharp scriber to mark the graduations on the edge of the screw, Fig. 15.

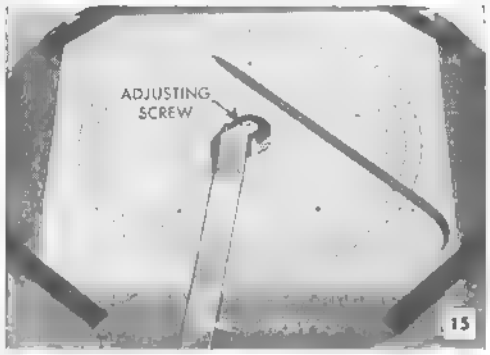
The next step is to machine the two beveled edges on the flange of the collet. These are cut roughly with a hacksaw first, leaving enough stock to finish to size. Beveling the edges is done in the lathe by mounting the collet on a 7/16-in. threaded arbor, 3 in. long, held between centers, and clamping the collet to a faceplate. Position the work at a 22½-deg. angle with a protractor and clamp a cutting tool to an angle plate bolted to the cross slide as in Fig. 16. The edges are beveled by traversing the lathe carriage by hand, using the cross-feed to advance the tool each stroke. Depth of the cut is adjusted by tapping the tool lightly with a hammer.

The guides for the collet, Fig. 13, are machined from one piece, Fig. 10, using the same setup as before to bevel the edges to match the ones on the collet. The stock for the guide is mounted edgewise between centers and at a 22½-deg. angle. Then it is clamped to the faceplate, the edges milled as in Fig. 17, and the piece sawed lengthwise into two parts. Drill two holes in each guide in the position indicated and then place the collet in the body, at the same time installing the adjusting screw and retainer screw. Clamp the guides to the body temporarily with paper between. Drill and tap four holes with a No. 43 drill and a No. 4-40 tap, and countersink. Saw away the waste stock around the outer edges of the guides leaving enough stock to finish-turn the parts flush with the body.

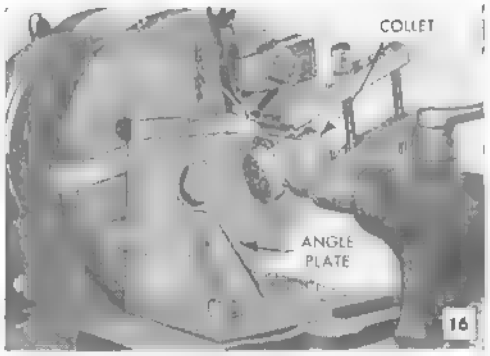
Now, fasten the guides permanently to the body. The collet should fit snugly between the guides. A ½-in. hole, Fig. 2, is bored in the end of the collet to take a ½-in. tool shank. This is done after turning the adjusting screw clockwise as far as possible. Then the collet is returned to the center position and the outer edges of the guides are turned. Finally, drill and tap the collet for a ⅜ in.-16 socket-head setscrew which locks the tool bit in position.



Collet and body bored together for adjusting screw



Template is used to calibrate head of adjusting screw



Setup for milling beveled edges on flange of collet

Manner of chucking stock for beveling collet guides

CONTOUR

By H. J. Chamberland

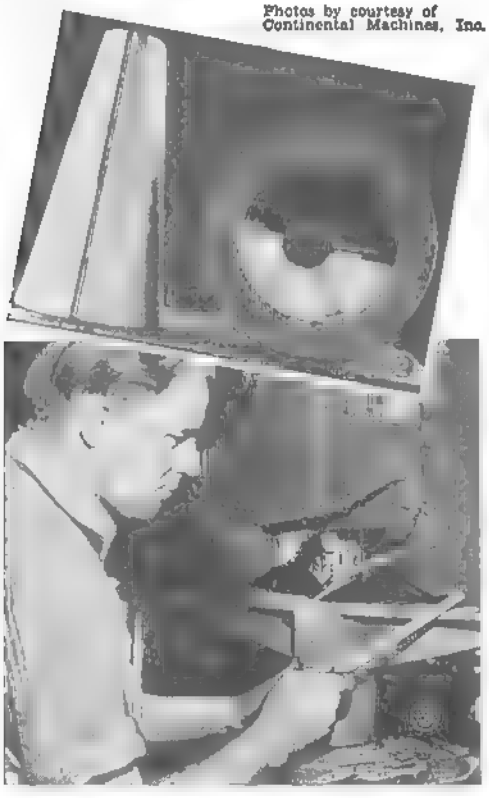
ALTHOUGH basically a band saw, a contour-sawing machine is especially designed to cut over seventy-five materials varying in hardness, including metals, plastics and wood.

Saves time and material: Many improvements made in contour machines, plus a variety of saw bands for various specific purposes, have made possible an almost incredible saving of time and material when the contour machine is compared in performance to that of other basic machines such as lathes, millers, shapers, planers, slotters, etc. As much of the work done by these other machines can be performed better and faster on a contour machine, they are relieved from unnecessary jobs and can be employed solely for work that cannot be done otherwise.

Figs. 1 to 5 inclusive show operations in which a great saving of time and material is possible. Outstanding among these examples is the material-saving operation shown in Fig. 2. Here a tapered hole, 5 in. in diameter at one end, 2 in. at the other, and 9½ in. in length, was cut with a contour machine without any appreciable waste of metal as a single cone-shaped piece was removed, which would have been reduced to chips if the hole had been bored on a lathe. Cutting a keyway 10 in. long in a shaper is a 4-hr. job, owing to the light

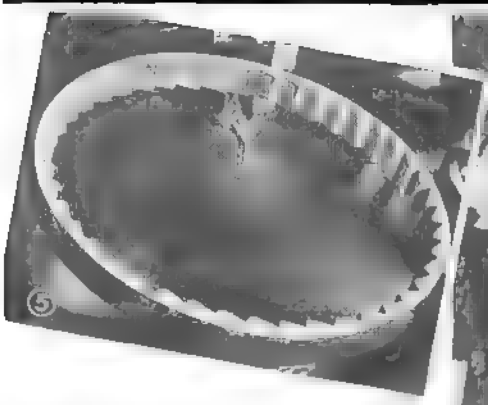
1—Contour-machining sector gears instead of milling made a 50 percent saving in costs. 2—Cone-shaped hole sawed in a large cylindrical piece without waste of material. Boring in a lathe would have resulted in chips. 3—The 10-in. keyway was sawed out in 20 min., which would take 4 hrs. on a shaper

Photos by courtesy of Continental Machines, Inc.



4—Cutting three slots in each of these disks required only 30 min. on a contour saw but would have taken 1½ hrs. on a milling machine

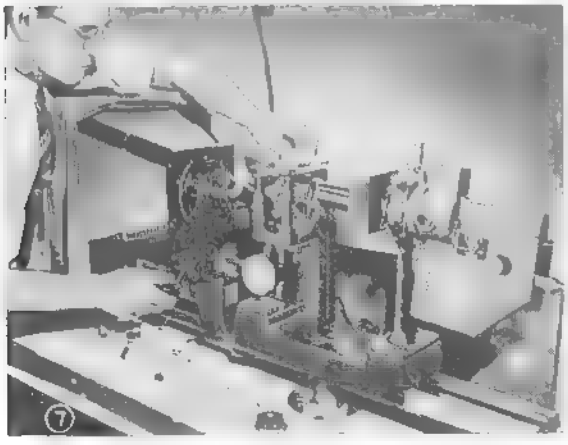
MACHINING



5—Another 4-hr. shaper job of cutting 45 teeth in a 20-in. internal ratchet was accomplished on a contour machine in one hour

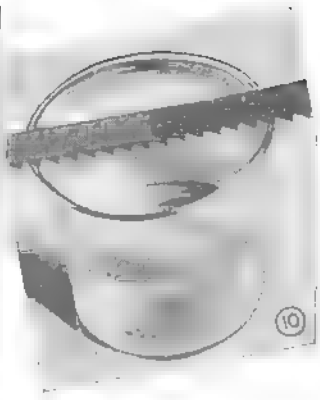
feeds required, but on a contour machine such an operation, shown in Fig. 3, was accomplished in 20 min. To cut three slots in each of the disks shown in Fig. 4 was only a 30-min. job by contour-sawing, whereas it would have taken 1½ hrs. on a milling machine; also, the small pieces cut out were found useful for other purposes. Fig. 1 shows another operation usually done on a milling machine—cutting off part of the tooth sections of gears. By means of a simple fixture to hold and guide the pieces on a contour machine, the work was done at a saving of 50 percent in production costs. The 20-in. internal ratchet shown in Fig. 5, which has 45 teeth, was formed in 1 hr. by sawing. This work required 4 hrs. in a shaper.

Easily and quickly mastered: As shown in Fig. 6, batteries of contour



6—Batteries of contour machines are found in many large production plants, forty or fifty units not being unusual. 7—Metal for saw bands being tested for grain structure with a metalscope, which shows enlarged views and makes photomicrographs

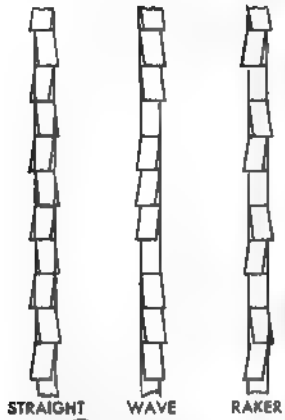
machines are found in many large plants, forty or fifty of them in one place not being unusual. Following a brief period of free instruction provided to industry by a large manufacturer of contour machines, the average apprentice can start to produce acceptable work. A contour-machining school turns out craftsmen in this work in a practical training period of 200 hrs. After the first day of instruction, trainees already are capable of turning out



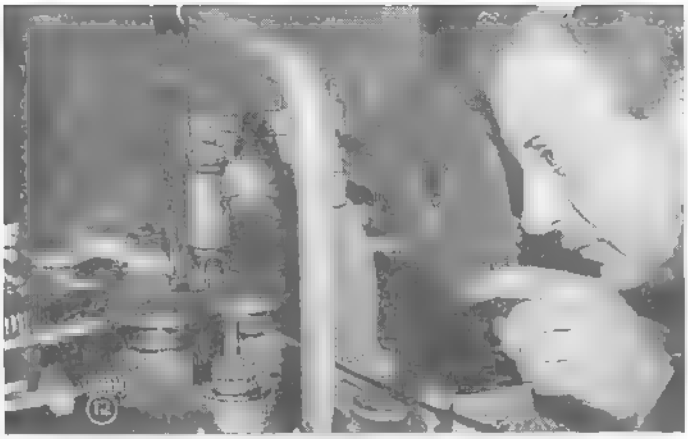
8—Teeth are milled in as many as forty saw bands at once, the bands being clamped side by side in an air-operated vise. 10—Acid test shows exact depth of flame-hardening on saw bands by discoloring hardened portions. 9—Tooth-setting machine that shows a magnified image of the teeth between limit lines so that operator can detect errors of set at a glance. The circular insert shows image as seen

lathe faceplate straps, wrenches and other useful items.

Precision in making the saws: Of the whole machine, the saw band itself, being the part that actually does the cutting, is of greatest importance. As a $\frac{1}{16}$-in.-wide band must perform as efficiently in its range as a ½-in. band, the material from which saws are made must meet exacting requirements, and the teeth must be milled, set and hardened uniformly with extreme accuracy. To assure that no inferior steel is used in making the saw bands, the raw material is first tested for grain structure with an instrument known as a metaloscope, Fig. 7, which provides highly magnified views of the metal under observation, and enables the operator to make photomicrographs. In milling the teeth, Fig. 8, as many as forty similar bands are clamped together rigidly in an air-operated vise. After the teeth have been cut, the bands go to a teeth-setting machine, Fig. 9. Here the set of the teeth is checked so that it does not exceed .001 in. from specifications. A magnified image of the teeth as projected on a screen is shown in the circular insert of Fig. 9. The image appears between fine lines so that the operator can detect errors at a glance. Next, the tooth portion of the bands is flame-hardened as shown in Fig. 12, so that the back of the band will remain flexible. Hardness must reach the bottom of the tooth gullets but must not exceed this. Depth of hardening is so important that all bands are given an acid test to show just how far hardening has taken place. See Fig. 10, which shows how the acid discolors the hardened teeth to a dark shade, while the back of the band, if untouched by heat, remains light.

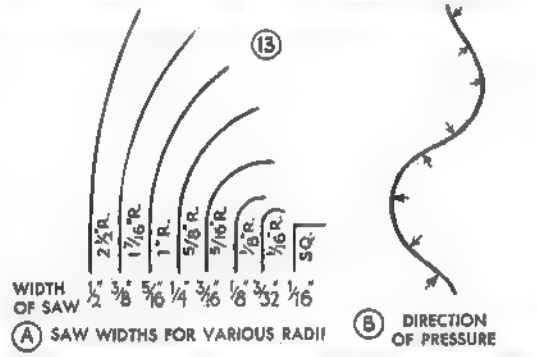


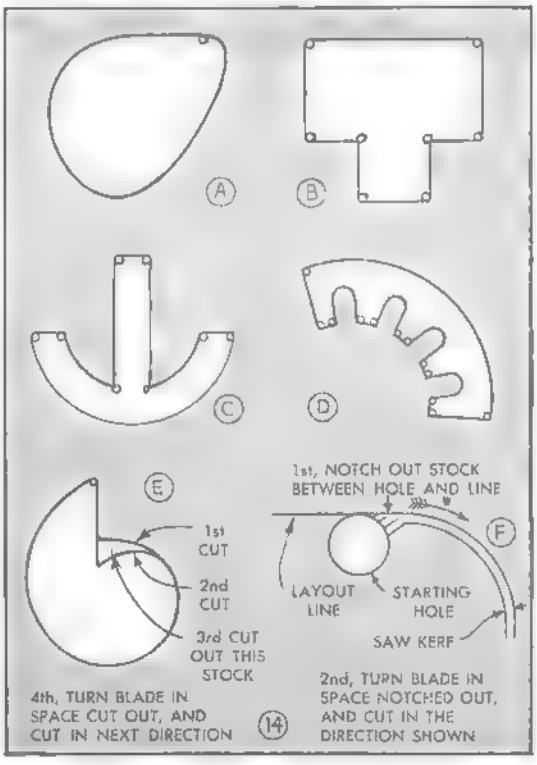
(11) TYPES OF SAWS

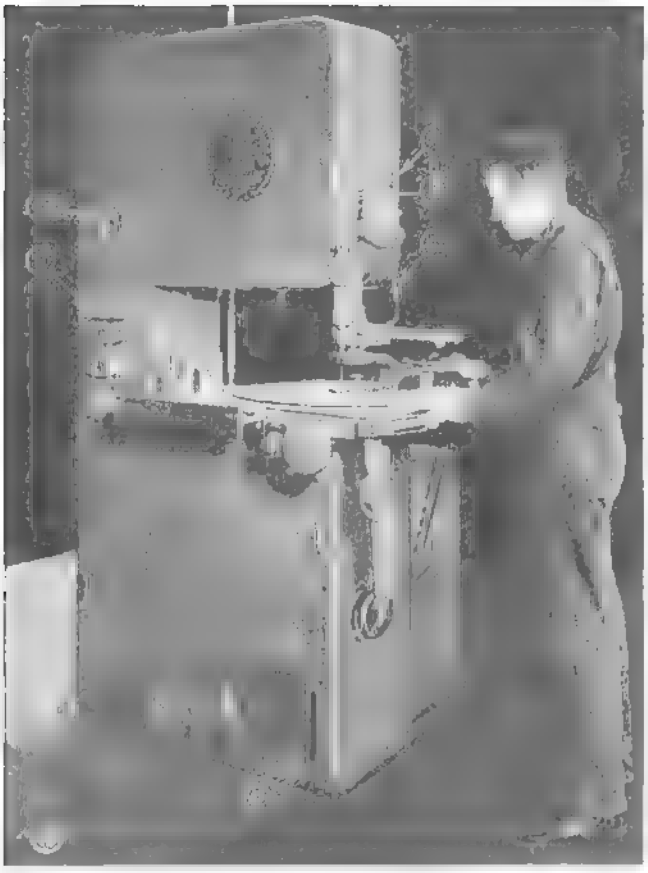

(12)

Types of teeth: There are three types of contour-saw teeth as shown in Fig. 11, the raker tooth predominating because it will cut all solid iron and steel. The wave tooth has the smallest possible tooth spacing and is used to cut sheet and tubular stock as well as stainless steel and ductile materials. The straight tooth clears the cut or kerf of chips, and is used for cutting brass, copper bronze, plastics and nonferrous materials.

Saw pitch: Contour saws are made in eight pitches (number of teeth per inch), varying from 6 to 32 teeth. The saws are made to cut curves and, although there are eleven widths ranging from $\frac{1}{10}$ to 1 in., the maximum width used is usually ½ in. The widest band possible should be used always, and this depends on the radius of the curvature that must be cut. Detail A of Fig. 13 gives the approximate radius that each width of saw will cut. The widest saw possible permits more feed and decreases chattering. Using the widest set of saws is also advisable; this has .007-in. clearance on each side, giving considerable freedom to the back of the saw. As the width of a contour saw decreases, the pitch must necessarily get finer, although wide saws can have any number of teeth per inch. A standard saw for general work is a raker-type saw with a pitch of 14 heavy-set teeth per inch. Although these saws are made in three varying degrees of temper, known as A, ■ and C, the A-temper is given preference at present. Generally, the coarser pitches are used on soft or thick materials and operate at slow speeds. The finer pitches are used on hard or thin materials, the saws being run at higher speeds. Accordingly, 6-, 8- and 10-pitch saws are used for solid sections







A—Starting switch
B—Job selector (gives correct speeds)
C—Air line blows out chips
D—Tachometer shows saw velocity
E—Panel light
F—Weld selector
G—Etching connection
H—Line voltage regulator
I—Welding lever
J—Welding jaws to clamp saws
K—Lamp and grinder switch
L—Annealing switch
M—Grinder to dress welds
N—Power-feed pressure control
O—Removable chip box
P—Power feed release pedal

Many built-in units and controls on modern contour machines enable operators to do fast and accurate work. References above apply to Figs. 15 and 16

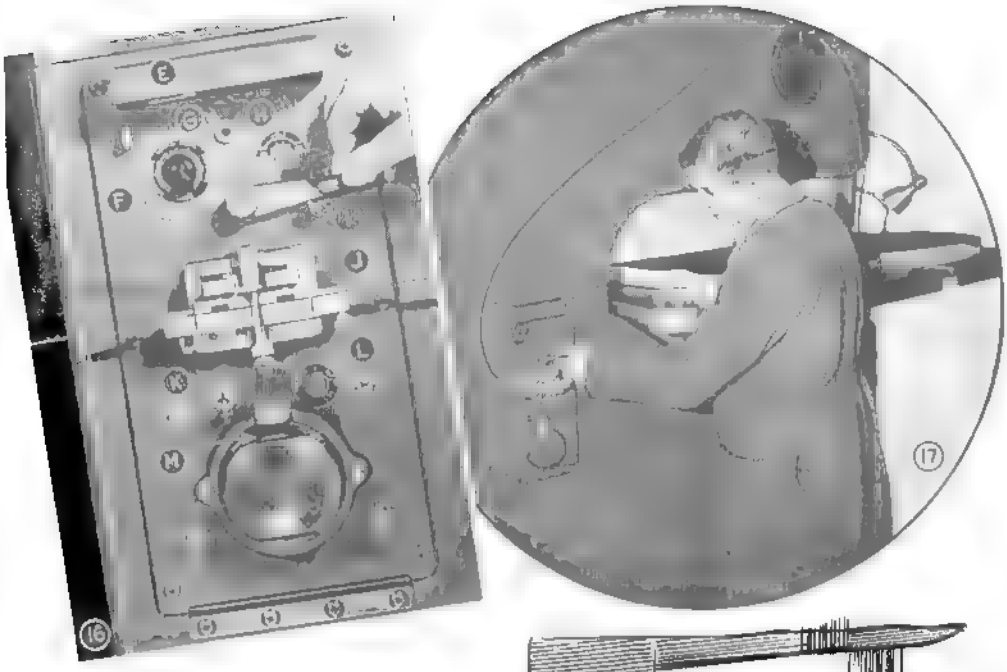
of soft materials over 2 in. thick; 12- and 14-pitch saws for solid sections of hard materials under 2 in. thick, and for heavy-gauge structural steel and heavy-gauge sheets; 18- and 24-pitch saws for light and very light solid sections, light structural metal, sheets and tubing. The 32-pitch saws are used mostly for cutting very thin sheets, tubing or pipe.

Holes to start internal cuts: To cut internal outlines one or more starting holes are required to insert the saw and to permit turning the work. Details A, B, C, and D of Fig. 14 show examples of everyday layouts for contour work. In many cases where four or more holes would be customary, the number can be reduced to one or two by notching a space with the saw to make the turns as shown in detail E of Fig. 14. Detail F of Fig. 14 shows how to follow the outline directly from the hole. When sawing curves, pressure should be applied as shown by the arrows in detail B, Fig. 13.

Determining speed, feed and saw pitch: Knowing the kind of material to machine, the operator simply turns a "job selector" dial, on the top cover of the contour machine (See Fig. 15) to ■ point designating the material. The selector gives the correct pitch of the saw to use, the speed and also the feed for the thickness to be cut. Having mounted the required saw band, the correct speed (50 to 2,000 feet per minute) is obtained by turning a hand wheel until a speed-indicator dial positioned at the left of the job selector, shows the speed desired. The wide range of speeds, very essential in cutting many kinds of materials of varying thickness, is provided by a built-in variable speed unit.

Welding saws: After a saw has been cut for internal machining, the severed ends are joined together again by welding, which can be done in a few moments on a built-in butt welder shown in Figs. 16 and 17. The severed ends of the saw must be squared on a small grinding wheel provided on the machine, before being aligned in the jaws of the welder, both of these operations being done after the saw has been passed through the starting hole in the work. The welding heat required for a particular width of saw is regulated by means of a "weld selector." After the saw has been allowed to cool slowly, the joint is annealed by operating ■ switch for this purpose. Then the welded joint is surface-ground on both sides until it passes through the weld-thickness gauge. The welding unit also provides a convenient means of connecting an etching pencil for the purpose of marking parts as shown in Fig. 18.

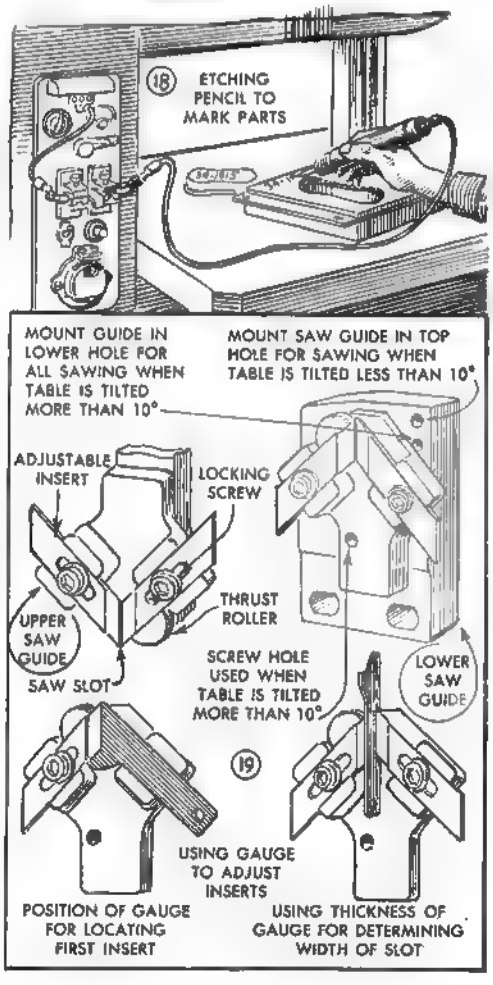
Adjusting the saw guides: Contour-sawing machines are equipped with specially designed saw guides and inserts as

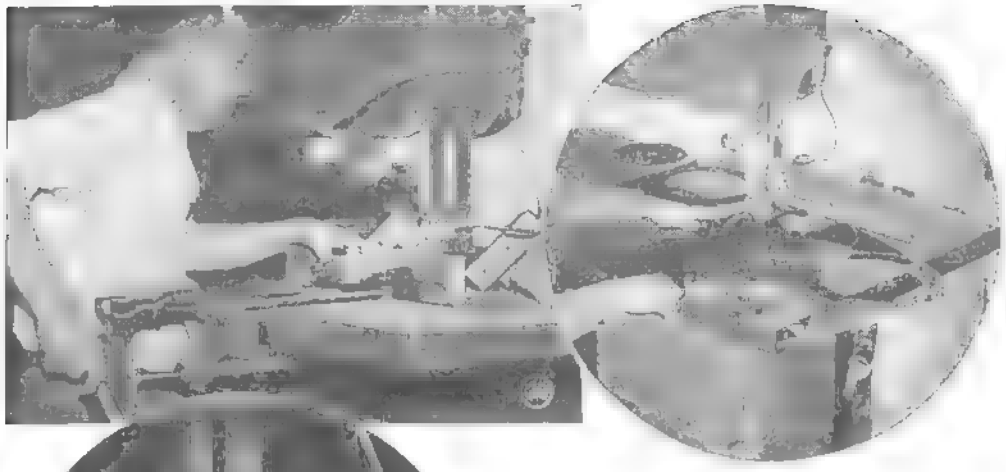


shown in the upper details of Fig. 19. There are several sets of inserts to suit all widths of bands. A gauge is provided to locate the left-hand insert and to determine the correct width of the slot, which is done before adjusting the right-hand insert. See the two lower details of Fig. 19. The saw must track perfectly before the inserts are adjusted. Proper coordination of precise tracking and adjustment of the inserts should cause the back edge of the band to contact the thrust roller lightly when the saw is not cutting.

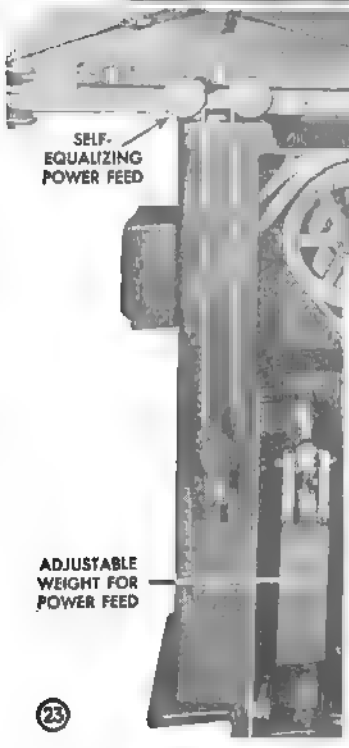
Contour-machine accessories: There are a number of accessories used to protect the operator against errors and help him to do better work. For example, the air jet as seen in Fig. 15, blows chips out of the saw kerf continually. This prevents generating heat, which would tend to weld chips to the saw teeth and eventually damage the saw. Fig. 22 shows a magnifying unit that enlarges the cutting location three times, enabling the operator to follow the layout line on the stock closely. Fig. 21 shows an attachment used to cut large circular holes up to 30 in. in diameter in stock up to 12 in. in thickness. Fig. 20 shows a cut-off and mitering attachment for making straight cuts at various angles, resulting in accuracy difficult to obtain if this were done freehand.

Importance of correct feed: Excessive feed will dull the saw teeth and produce bellied surfaces. Customarily, hand feed is used when making light cuts, but for heavy cuts the power feed, illustrated in





Figs. 23 and 24, releases both hands of the operator to guide the work. The feed depends on the width of a saw, the nature and thickness of the material. Soft or fast-cutting materials will stand a pressure of 50 lbs. with a ⅜ to ½-in. saw. A pressure of 35 to 40 lbs. is advisable for steel being cut with a ¼ to ⅜-in. saw, but not more than 25 lbs. should be used on a ⅛ to 3/16-in. saw. When sawing parts having a variable thickness, the saw part of the time is cutting a thickness that is greater than that of the material itself as is the case when the saw enters the wall of a pipe. In such cases the saw velocity for the minimum thickness of the work is too great for that of its maximum thickness. Then the saw pitch should be based on the thickness of the material but the saw velocity should be based on double the thickness. The operator can determine easily what adjustment should be made in such cases by simply referring to the job selector incorporated in the machine, as shown in Fig. 15.



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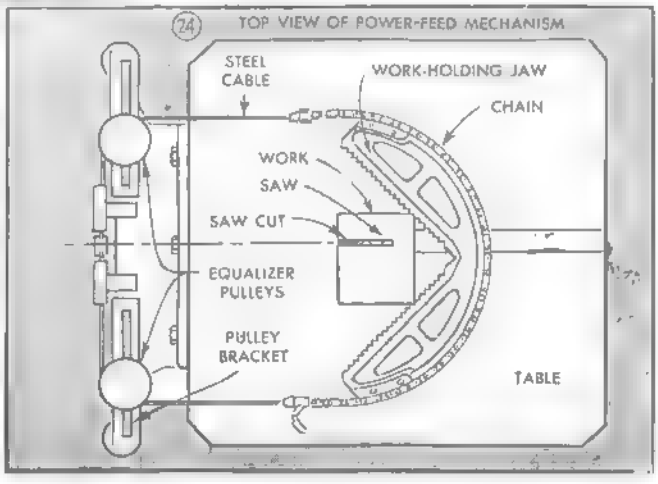
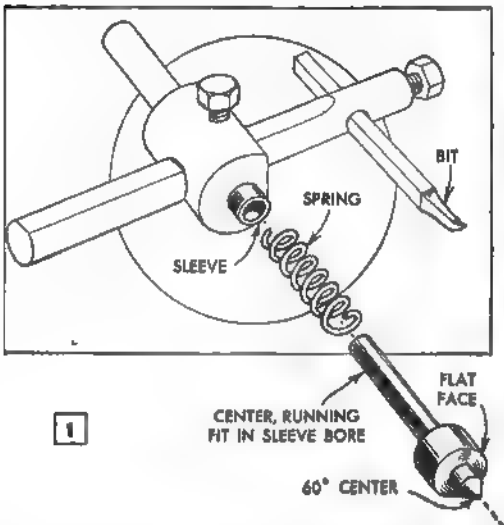
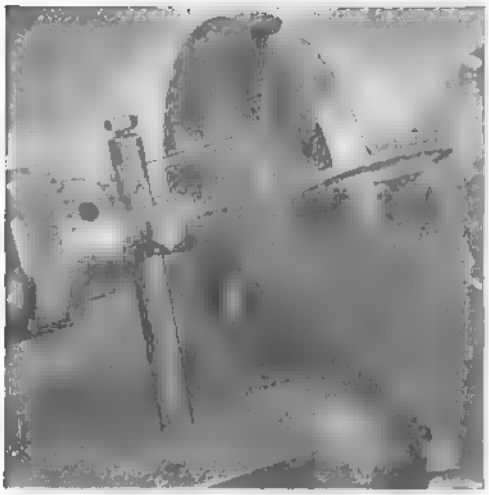
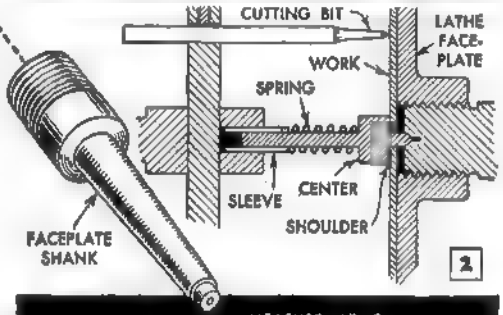


TRUE HOLES in LIGHT METAL



1

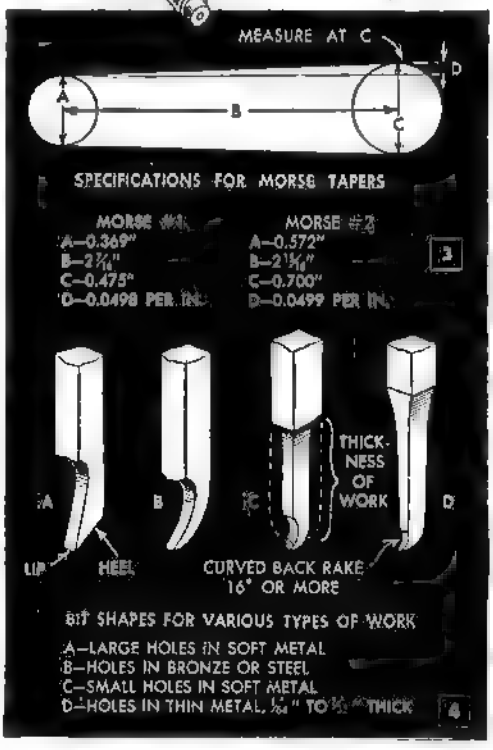




2

USING this exceptional tool, it's possible to cut a true hole every time without the usual distortion or elongation. The tool is attached to the headstock of a lathe and the work is backed by a faceplate screwed on the end of a specially turned shank inserted in the tailstock spindle. The tool is made from a standard adjustable hole cutter by removing the center drill and installing a steel sleeve, spring and center fixture, as in Figs. 1 and 2. The shank of the center should be a running fit in the sleeve bore and the bearing surface should be kept well oiled. A 15-lb. diemaker's spring is required to produce the desired thrust. Faceplate shank is threaded to fit the faceplate and the shank is turned to a Morse No. 1 or 2 taper, depending on the tailstock spindle. Dimensions for both tapers are given in Fig. 3. The threaded end of the shank is center-drilled to take pointed tip of the center fixture. In operation, the pilot hole in the work fits over the 60-deg. center which is engaged by the faceplate shank. The faceplate is advanced to allow the flat face of the center fixture to grip the work. When once adjusted, the feeding is done with the tailstock ram. Should a disk be desired without the pilot hole, it can be cut by clamping the work to the faceplate.

Various cutter bits and their uses are indicated in Fig. 4. These bits are made only from the hardest alloy steel honed to a razor edge. When a bit is used on a hole of smaller diameter than that for which it was designed, it may rub. In this case, part of the heel must be ground away to give the desired clearance. When using the tool, remember to keep the feed pressure light, as heavy feed will cause the bit to dig in.

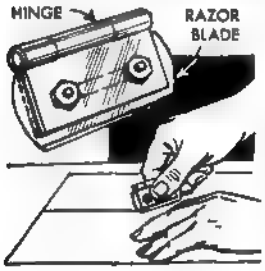


Pipe Mounted in Wood Lathe With Aid of Plug "Centers"

Not having a metal-turning lathe to turn down a length of pipe for a sliding fit through a pipe tee, one man did the job on his wood lathe with a file. First, turn a 6-in. length of hardwood to a diameter slightly greater than the inside diameter of the pipe. Check to see that it is a tight fit in the pipe, and cut it in half to form two 3-in. plugs. Tap a plug securely into each end of the pipe, leaving about ½ in. of the plug projecting. Center the unit in the lathe and see that the spur and tailstock center enter the indentations made when the plugs were turned. With the lathe running at a speed of approximately 1200 r.p.m., rough-file the pipe to size with a double-cut flat file and then finish the surface with emery cloth. When the job is completed, the tight-fitting plugs are removed from the pipe by clamping them between the jaws of a machinist's vise and turning the pipe.

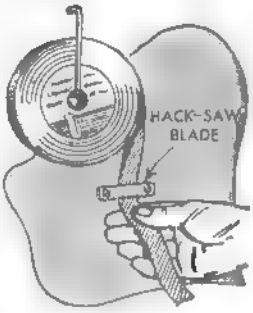
C. R. Schlegel, Jenkintown, Pa.

Hinge Forms Razor-Blade Holder



When using a double-edged razor blade to rip seams, scrape paint or cut paper, a holder to protect the fingers can be improvised by clamping the blade between the leaves of a small butt hinge. Select a hinge that will cover the top edge of the blade completely, and fasten the latter with two small stove bolts inserted through the slot in the blade.—Ronald Eyrich, Milwaukee, Wis.

Abrasive-Cloth Dispenser



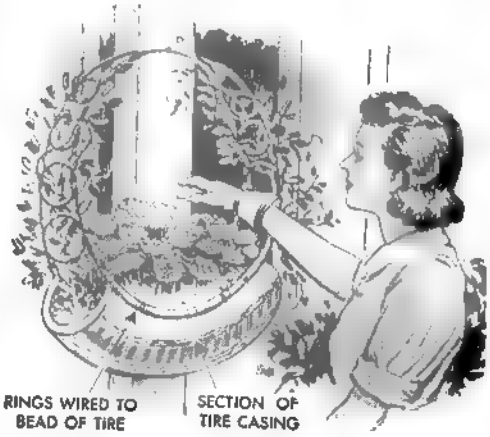
Strips of roll-type abrasive tape are easy to tear off if the roll is mounted in this simple dispenser. Bend a piece of heavy wire to the shape of a wide staple and sharpen both ends so they can be driven into a wall to hold the roll as shown. Make the staple large enough to allow a full roll to rotate freely. A short piece of hacksaw blade is screwed to the wall to serve as a tearing edge. Thread the cloth under the blade with the grit side toward the wall so that grit will not clog the teeth of the blade when tearing.

Benj. Nielsen, Aurora, Nebr.

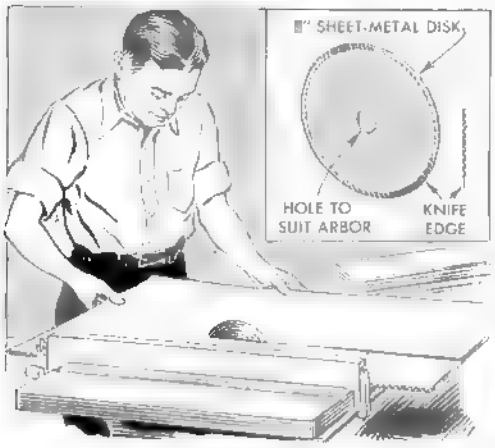
Unusual Hanging Flower Box Made From Auto Tire

With a section of auto-tire casing, two metal rings and some wire, it is easy to make this novel flower box. When the box is fastened to a porch column, vines and flowers trailing over a grille produce an unusual floral effect. Fasten the two supporting rings to the tire with wires through holes punched in the bead. Wire the rings together at the top and solder a grillwork between them, forming it in an attractive design. Finish with enamel.

Wm. M. Maddox, Jackson, Ga.



Strips of Cardboard Cut Quickly With Knife-Edge Disk



Where strips of corrugated cardboard were used to pack glassware in a manufacturing plant, difficulty was encountered because the cardboard was too thick to cut with a knife and sawing left rough edges. The solution was accomplished by making a disk of metal about as thick as stovepipe and sharpening it to a knife edge. Mounted on a saw, the disk cut the cardboard with ease and left it with smooth edges.

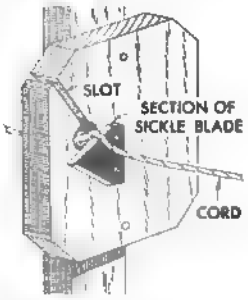
Preventing Tape From Unrolling

In a shipping department where gummed tape is used to seal packages, it was found that without a holder the tape unrolled and was difficult to use. One clerk overcame this trouble by coating both sides of the roll with rubber cement. Not only does this prevent the tape from unrolling, but also seals the sides against moisture.

Color Bands Identify Oil Bottles

By painting the spouts of oil bottles with different colors and numbers of bands, one filling station is able to identify any grade or viscosity at a glance. This saves considerable time and means that the customer can be served quicker. The bottles are filled during off periods when the attendant is not busy with customers.

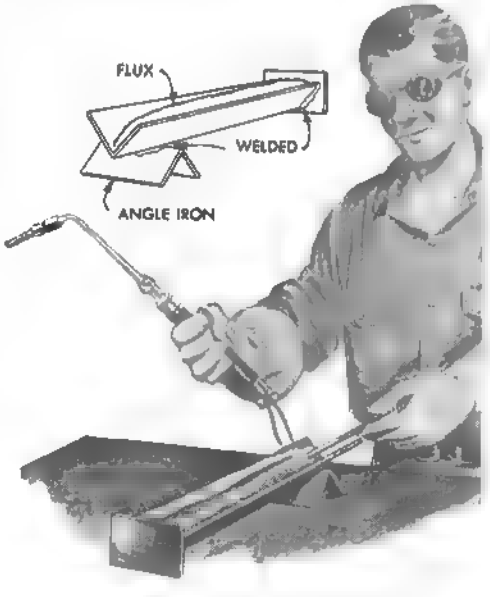
Sickle Blade Makes Twine Cutter



With an old sickle section and a scrap piece of hardwood, a safe and efficient twine cutter can be made in short order. The wood is cut square and the four corners are trimmed. Then a slot ending in a drilled hole is made. Mount the cutter so that one of the cutting edges partially covers the hole in the block. When the section becomes dull, it can be reversed. Fasten the unit to a post or at any other place convenient to binding and tying operations.

Metal Trough for Welding Flux Saves Time on the Job

When using rods that are dipped in flux, a welder can save much time if the flux is poured into a trough so that more of the rod can be covered at a time. The trough, which is about 1 ft. long, is made of angle iron with one end closed and the other supported by a shorter angle. One twirl of the fingers covers the rod with flux. Be sure to pour the flux back into the can and seal it after finishing a job.

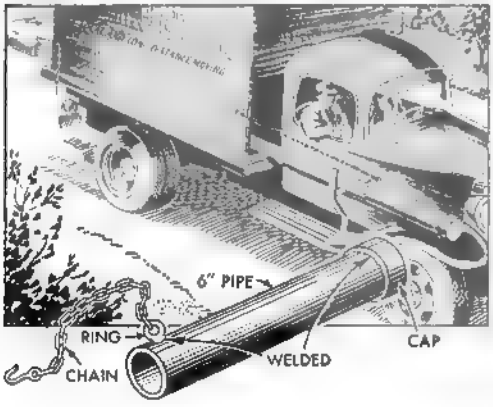


Knife Blade Set in Contour Pen Cuts Ben Day Speedily

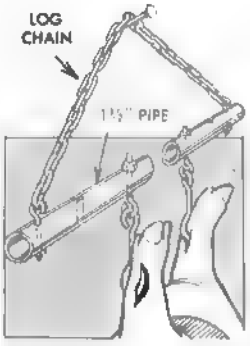
Trimming the edges of Ben Day and similar transparent application patterns can be speeded greatly by using a knife formed by clamping a thin blade between the jaws of a discarded contour pen. Such a knife can be made by grinding down a small blade so that it fits snugly in the pen. Then both blade and pen are cleaned and tinned and sweat-soldered together.

Iron Caps Slip Over Long Pipe To Keep It on Truck

Truckers who are called upon to haul long pipe, rods, etc., that project from both ends of the truck body, often experience considerable difficulty in preventing the material from slipping either forward or backward when traveling over hilly country. One hauler finally solved the problem by making holders of 6-in. pipe like the one shown. These were slipped over bundles of the material and fitted with chains hooked for attaching to eyes mounted on the truck body as indicated.

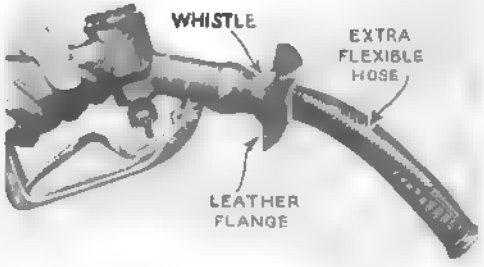


Gambrel Hooks Are Adjustable To Suit Various Animals



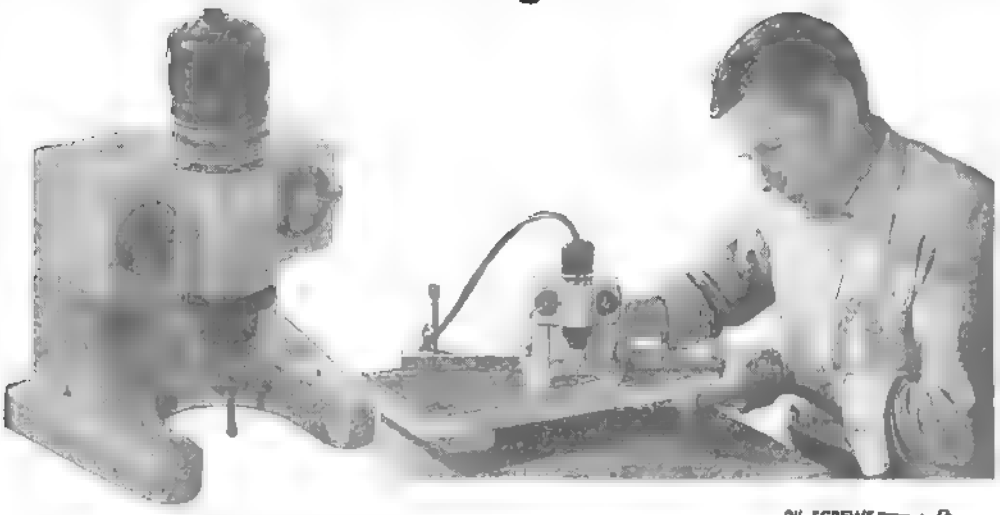
Instead of having several gambrels of different lengths for suspending animal carcasses of various sizes, a butcher uses this adjustable one. A 5-ft. length of 1½-in. iron pipe is drilled at suitable intervals to take ⅝-in. eyebolts on which hooks are hung for suspending a carcass. The pipe is held by a chain as shown, the eyebolts being spaced as required for the hooks to engage the legs of large or small animals.

Whistle on Gasoline-Pump Hose Tells When Tank Is Full



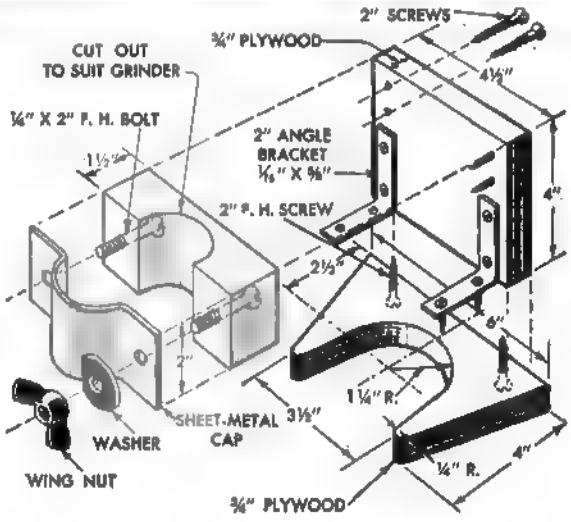
When a motorist tells the owner of a gasoline service station of Lasara, Tex., to "fill 'er up," the service station proprietor does so without looking into the filler hole to see when the tank is full. He gets a signal when air displaced by gasoline as the tank fills sounds a small whistle on one side of the filler hose nozzle. The whistle is mounted on the end of a short flexible hose as indicated. When the gas level in the tank reaches the bottom of the short hose, air cannot enter and the whistle stops. Length of the extra hose is determined by the lengths of the tank filler tubes most commonly serviced. A leather flange at the upper end of the hose nozzle fits over the tank filler tube to help prevent displaced air from escaping without passing through the whistle.

Holder Permits Routing With Hand Grinder

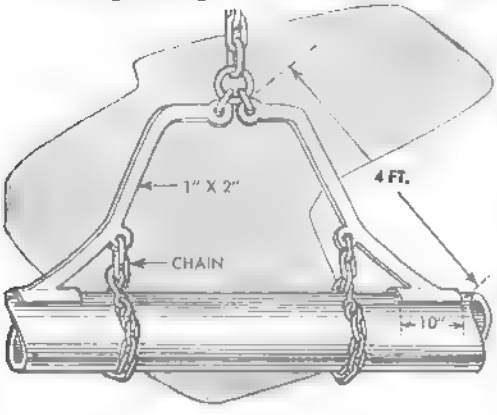


Here is an exceptionally useful jig that permits using a hand grinder for accurate routing to specific depths. In addition to ordinary routing jobs, it's ideal for intricate pattern work as it provides for maximum lateral control of the tool. The base and back of the jig are of ¾-in. plywood and are fastened together with angle brackets. The holder for the grinder is formed by cutting out one side of a wooden block to suit the diameter of the grinder. Then a sheet-metal strap to clamp the grinder in position is bent, drilled and attached with wing nuts to bolts countersunk in the block. To use the jig, position the grinder in the holder to the proper routing depth and tighten both of the wing nuts.

E. R. Lucas, Poulsbo, Wash.



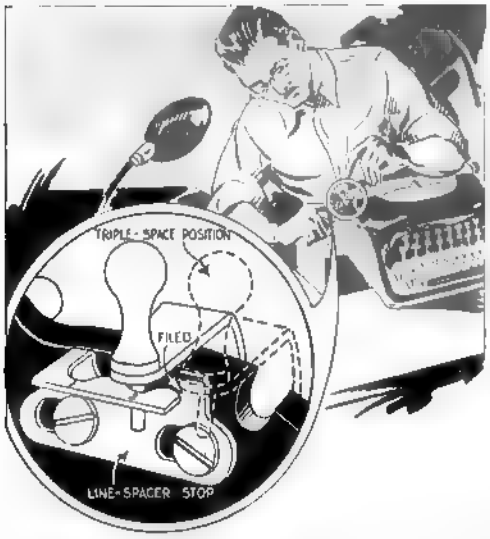
Hoisting Tongs Provide Safe Hitch for Lifting Heavy Pipe or Poles



Designed and used by a western contractor engaged in loading power poles, these safe hoisting tongs work similar to a pair of ice tongs—the weight of the object tends to increase the grip. Chained to the load near the point of balance, the tongs keep the load in a horizontal position when lifted. The tongs are made from 1 by 2-in. flat iron, heated and bent to the shape shown. Eyes are welded to take a hoisting ring at the top and two grab chains which wrap around the load. Cupped saddle plates are welded to the ends of the tongs to ride the curvature of the particular pipe or pole being lifted.

William P. Houser, Organ, N. Mex.

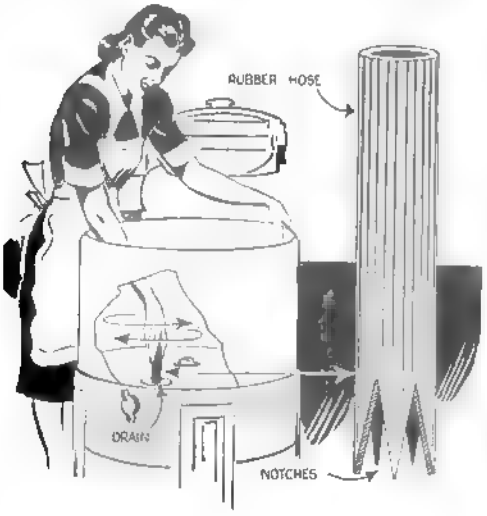
Altered Line-Spacer Stop Permits Triple Spacing on Typewriter



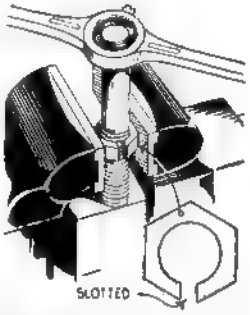
On some portable typewriters that permit only single and double-spacing of the lines you can alter them to triple space by changing the spacer stop. The alteration consists of filing away the spacer stop so that the adjusting pin can be moved farther back as shown in the drawing.

Piece of Hose With End Notched Cleans Washing-Machine Drain

For removing lint that frequently clogs the washing-machine drain, cut long notches in the end of a length of garden hose and use this as a cleaning tool. When the hose is inserted in the drain opening with a twisting motion, the notches in the end will engage the lint and it can be removed by withdrawing the hose.

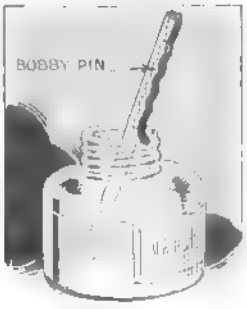


Slotted Nut Holds Stud in Vise For Threading



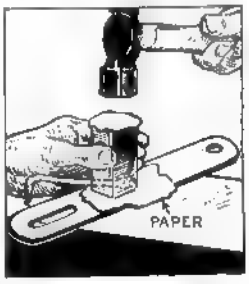
When a stud has to be threaded at both ends, one threaded end can be gripped in a vise by using a slotted nut. The nut is turned onto the threads and then clamped between the vise jaws, the slot permitting it to be squeezed tightly against the threads to grip the stud and hold it while the threads are being run on the other end.

Handle of Glue Brush Kept Clean By Clipping It to Bottle



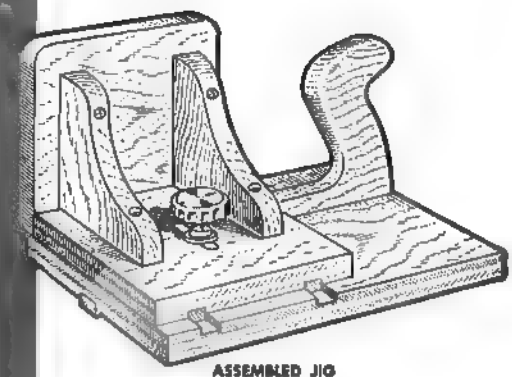
To keep a glue brush from sinking to the bottom of the bottle and getting the handle sticky, just clip it to the mouth of the bottle. A bobby pin will serve as a clip, and is attached by pushing one leg down inside the hollow handle of the brush, letting the other leg project on the outside.

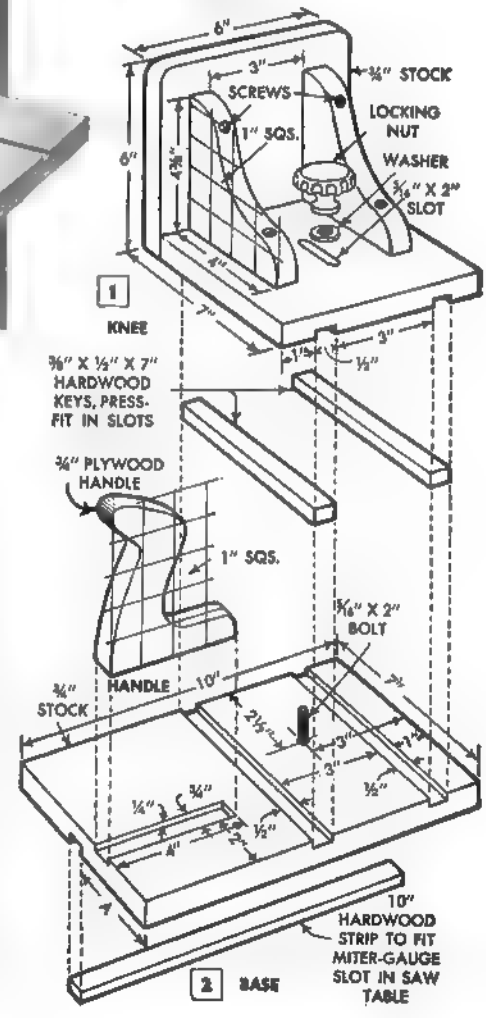
Loose-Riveting ■ Hasp Hook



The difficulty of re-riveting a hasp hook so that it will operate freely can be avoided with a sheet of paper. This is placed between the hasp and hook before clinching the rivet, after which the paper is torn away, thus spacing the two parts so that they work freely.

¶Tape ■ garden hose to the handle of a floor brush so that it directs a stream of water ahead of the brush for a quick scrubbing job on shop or garage floors.



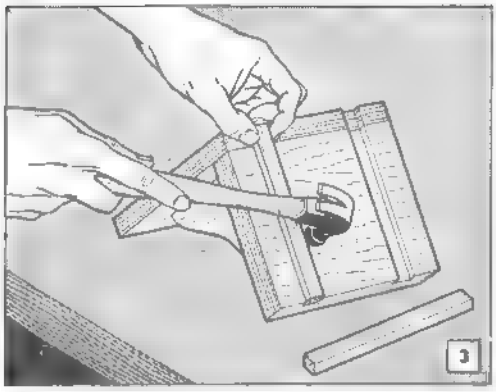


TENON JIG

SLIDES IN TABLE SLOT

NOT ONLY is this wooden jig invaluable when sawing the cheek cuts of tenons, but it is a saw attachment that should be in every home workshop because it affords maximum safety in cutting tenons of small size. The jig is designed to slide in the table groove provided for the crosscut guide, and when its handle is grasped and pushed forward like a hand plane, the jig feeds the work parallel with the blade. Thus, with the work clamped to the jig and the hand away from the blade, the chance of injury is remote when cutting even the smallest tenon.

By using two saw blades spaced with a collar equal to the thickness of the desired tenon, both cheek cuts can be made at one time, after which the shoulder cuts are made in the usual way. In addition to speeding the operation, the jig permits cutting an accurate tenon of uniform width regardless of



the irregular thickness of work being cut.

The original jig was made in two separate parts: the knee against which the face of the work is placed, and the base which has a runner on the bottom to fit the table groove. Figs. 1 and 2 detail these parts respectively. The knee has runners on the underside, Fig. 3, that engage grooves in the top side of the base, so that the former is adjustable laterally to suit the thickness of the work. The knee is locked in position with a handwheel.

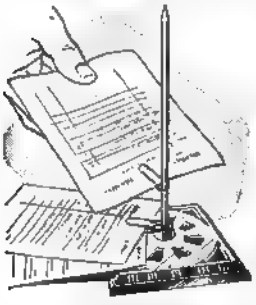
In running the dadoes for the knee runners, cut corresponding grooves in both pieces at the same fence setting. That is, set the saw fence 1 in. from the blade and run a dado in the knee and one also in the base. Then move the fence for the second cut. In this way, corresponding dadoes will align perfectly. It is important that the dadoes be cut exactly at right angles to the base as the face against which the work is clamped must be parallel with the blade. A shoulder or stop for the work is clamped to the face of the knee to suit the end of the work. If the tenons are to be cut on work having square ends, the stop, which is simply a wooden block, is clamped perpendicular to the surface of the saw table. If a miter tenon is to be cut, the stop is clamped in a 45-deg. position or at whatever angle is required. Thus, the stop is used to position the work in relation to its end.

Heavy Tractor Weights of Concrete Cast in Flat-Rimmed Wheels

Permanent forms for casting concrete weights for rubber-tired tractors are improvised from discarded tractor front wheels having flat rims. Such wheels usually can be picked up in a junk yard. Remove the spokes from the wheels, leaving only short stubs at the rim end to embed in the concrete. Any can of suitable size will provide an inner form for the hub opening. Bolts may be embedded in the concrete and spaced to span the tractor-wheel spokes, or the concrete can be cored to take U-bolts. If regular bolts are used, metal plates are needed to center the weight on the wheel.

A. M. Wettach, Mt. Pleasant, Iowa.

Clipping Papers to Spindle Facilitates Handling



Shipping orders, invoices, etc., will not be punctured or torn if they are attached to a spindle with paper clips. In addition, this method permits a particular paper to be taken from the spindle without tearing it off or removing the papers above it. Also, papers can be filed in any desired order by first placing a number of clips on the spindle and then attaching the papers to the clips.

H. Klein, Pittsburgh, Pa.

Magnetized Sheet-Metal Masks Speed Spray Painting

In our sheet-metal shop we use lightweight metal jigs to mask the finished pieces for production paint spraying. However, the jigs had a tendency to lift up when the spray gun was passed over them, thus spoiling the paint job. I corrected this trouble merely by magnetizing the jigs so that they would hold fast to the work. In this way, we saved much time and extra work.

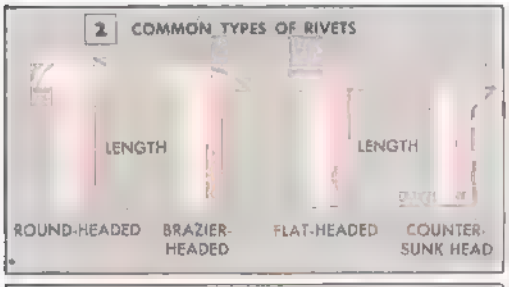
L. Justin Basher, Lancaster, N. Y.

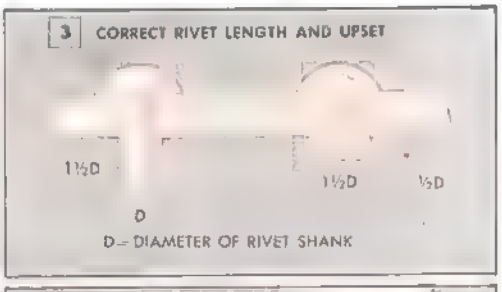
HOW TO RIVET ALUMINUM

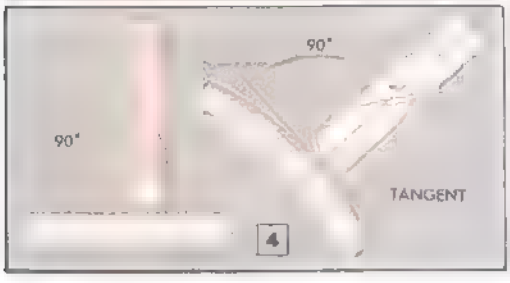
By R. J. De Cristoforo

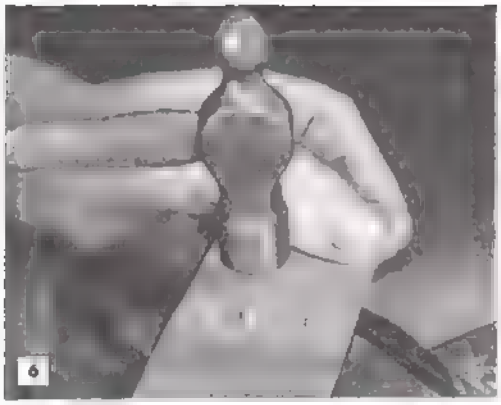
RIVETING aluminum sheets, either in factory production or in the home workshop, requires a specific procedure to produce maximum strength in the joint without any distortion of the material. In nearly all types of work the rivet pattern, Fig. 1, is important not only for decorative effect but for resistance to shearing or buckling of the joint. The type of rivet to be used is selected according to the nature of the work and the type of joint which is most suitable to the project in hand. The four rivet types shown in Fig. 2 will meet all ordinary requirements. If decorative value is a factor in the selection, then the round-headed and also the brazier-headed rivets usually are best. Use the round-headed type to join the heavier sheets where greater strength is required. The size and thickness of metal in the head is designed to strengthen the area around the rivet hole. When thin sheets are to be joined, a brazier-headed rivet is the one to use as its broad head gives a maximum grip on the area surrounding the rivet hole. In places where the structural members are a close fit, the flat-headed rivet provides that extra clearance so often needed for bucking with a flat bar. Rivets with countersunk heads are used when the surface of the riveted joint must be flush. It is important to remember that the length of the countersunk-head rivet is measured from the top of the head while in all the others the rivet length is the length of the shank and not the over-all length.

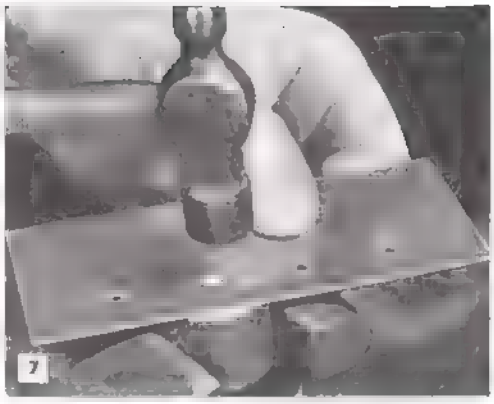
The length of the rivet in relation to the thickness of the work is illustrated in Fig. 3. Approved practice requires that when the head of the rivet is seated, the projection of the shank below the lower, or inside, surface of the metal should be 1½ times the diameter of the shank before upsetting, as in the right-hand detail, Fig. 3. In ordinary practice the rivet hole is made the same diameter as the rivet shank to give a very light press fit, but in production fabrication some specifications call for



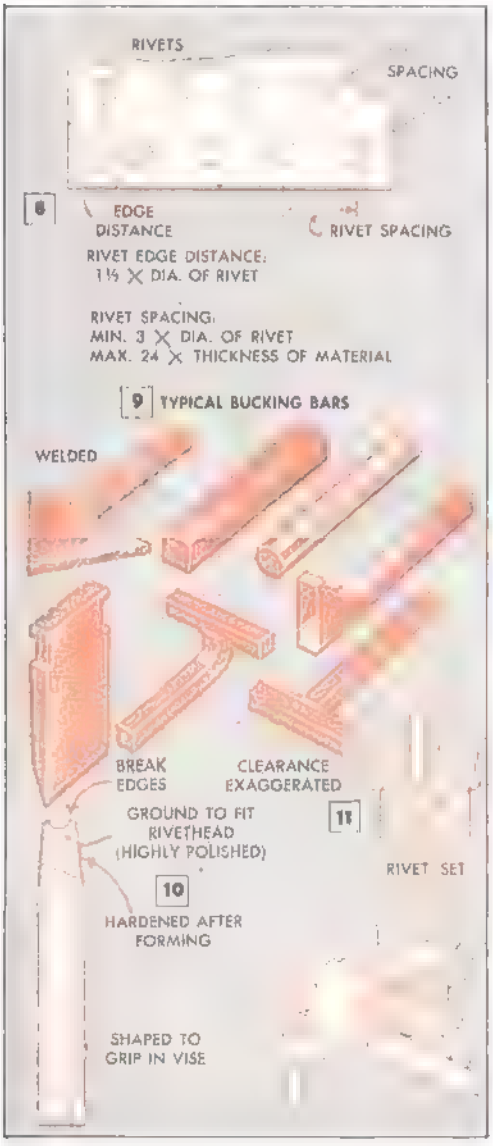






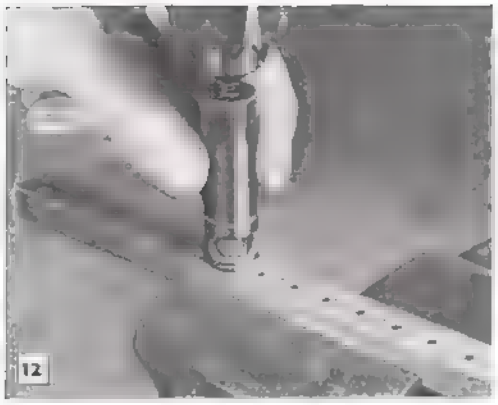


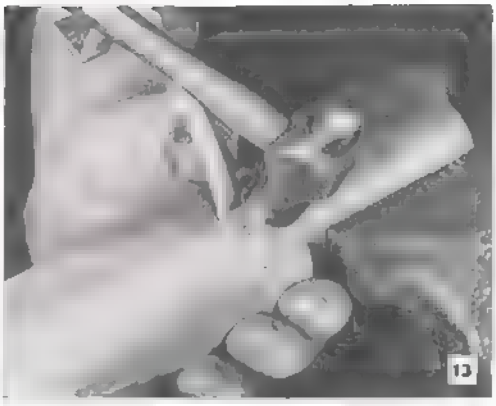
Rivets an dimples are upset in the usual manner. A rivet of the same size can be used as a dimpling die



slight variations. In any case, the hole should be drilled with care to avoid undue burring. Be sure that the drill bit is properly sharpened for drilling aluminum. In breaking the hole through, care should be taken that the drill chuck does not spin against the metal surface and score it. After drilling, all holes are burred. In the small shop, this can be done with a burring tool made from an old square-shanked drill bit fitted into a file handle, Fig. 5. Be especially careful when burring thin metal to avoid depressing the metal around the hole. Good practice demands that, where the joints require a line of rivets, the holes be drilled in a precise pattern as in Fig. 8. Angle of the drill with the work, Fig. 4, should be uniform when drilling a series of holes. Both the lengthwise spacing and the edge spacing should be laid out to exact dimensions. If there are two lines of rivets, the holes are staggered and the lines are accurately spaced.

When riveting guns are used, the shank of the rivet is upset with a bucking bar, or dolly, Fig. 9. In some kinds of work, the bar also is used to bear on the head of the rivet while the shank is upset with a hammer. Bucking bars usually are made up in the shape required. In handwork, using round-headed rivets, the rivet set, or anvil, is used when upsetting. One end of the set is tapered as in Fig. 10 and the end is recessed to a radius slightly greater than that of the rivethead. This is done to give a clearance as in Fig. 11. Break the edges at the recessed end with a light beveling cut while the work is still in the lathe. The straight end of the rivet set can be shaped as in Fig. 10 so that it can be gripped in a vise or fitted in a hole drilled in a steel block as in the right-hand detail, Fig. 10. When using the set, be sure to hold the work square, otherwise the edges of the set may mar the work. Flat-headed and countersunk rivets can be upset neatly on any



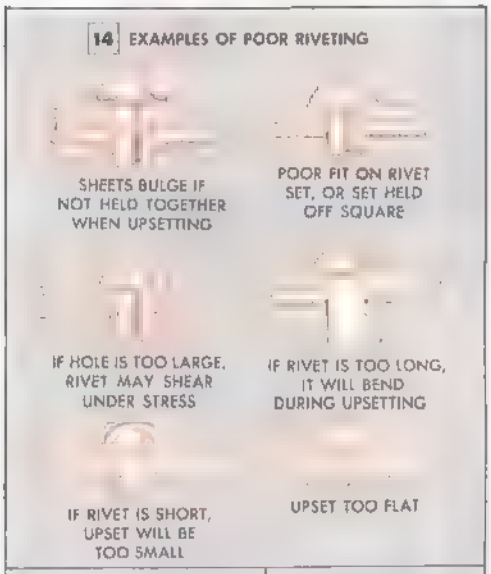


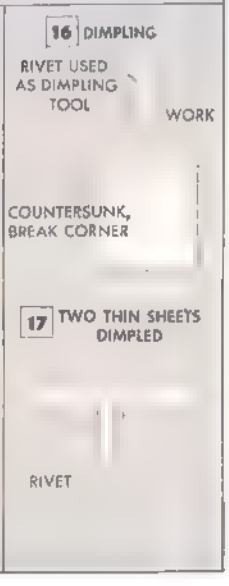
Automatic countersink assures uniform work. Tubing is riveted over a round bucking bar held in the vise

flat metal surface, but to assure that the rivethead will be flush after upsetting, it is necessary that the parts of the work be held tightly together. In order that countersunk rivets shall be perfectly flush when upset, it is necessary that the holes be countersunk to a uniform depth. Fig. 12 shows an automatic countersink in use. It is held in a drill chuck and can be set to countersink with exact uniformity at any average depth. Countersinking by hand will be less uniform of course, but with care it can be done with sufficient accuracy. In handwork, the tendency is to run the countersink too deep. When this happens, drill a hole in a small piece of steel and countersink it slightly undersize. Then spread the rivethead as shown in Fig. 15 so that it will fill the countersink flush when the shank is upset. When using rivets with countersunk heads on thin material where the depth of the head will not permit countersinking the metal, the rivet holes are drilled and then the two thicknesses of metal are dimpled as in Figs. 16 and 17. Make a dimpling bar by drilling a rivet-sized hole in a piece of round steel. Countersink the hole and break the edge, as indicated in Fig. 16, by simply beveling the edge slightly with a large drill bit held in the hand. Then use a rivet as a dimpling die as in Fig. 7. Burr the dimples lightly on one sheet only and when joining the work upset the rivets on the dimples as in Fig. 6.

Fig. 14 pictures the most common faults in riveting thin material. Although any one of these will produce a poor and unsightly job, the most frequent errors are in drilling holes oversize, using too short or too long a rivet and, on round work, Fig. 13, tending to upset the rivet too flat. For better results some riveters round the upset slightly on this type of work.

¶To loosen a rusted screw, press a hot soldering iron against it for a few minutes.

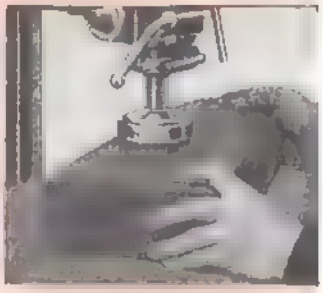




CRAFT QUIZ

1. Snowshoe frames are made of—
   (a) Northern pine (c) Hemlock
   (b) Hickory (d) Northern cedar

2. He is cutting a—
   (a) Tongue (c) Rabbet
   (b) Groove (d) Cove



3. This drill-press accessory is a—
   (a) French spindle (c) Carving bit
   (b) Molding head (d) Planer head

4. This work on a circular saw is—
   (a) Gumming (c) Kerfing
   (b) Swaging (d) Rolling

5. This 2-in. spiral has a lead of—
   (a) 3 in. (c) 1 in.
   (b) 1¾ in. (d) 4½ in.

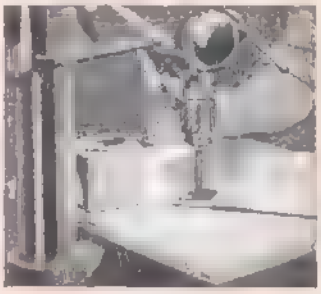
6. For smoothest cross-cutting, use a—
   (a) Planer saw (c) Rip saw
   (b) Chamfering saw (d) Crosscut saw

7. Band-saw blades require—
   (a) Gumming (c) Free wheeling
   (b) Tracking (d) Roller guides

8. This table leg has a—
   (a) Pad foot (c) Dutch foot
   (b) Claw foot (d) Ball foot

9. Wood to turn this ball is—
   (a) Walnut (c) Maple
   (b) Mahogany (d) Yellow pine

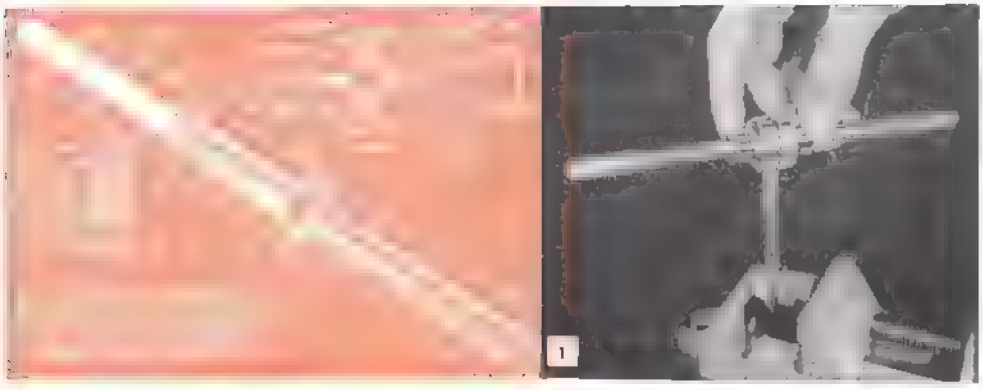
ANSWERS: 1—b; 2—a; 3—d; 4—a (sometimes called gulleting); 5—b (lead is distance thread advances in one revolution); 6—a; 7—b; 8—c; 9—d; 10—c & d (bort is another name for diamond dust); 11—d



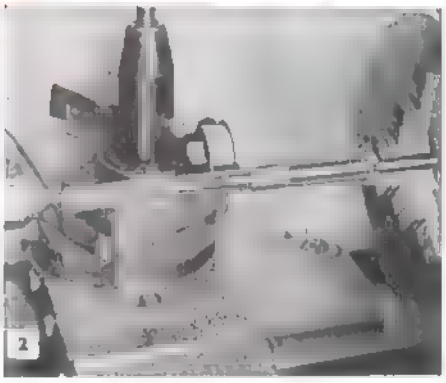
10. Best abrasive for glass drilling is—
    (a) Silicon carbide (c) Diamond dust
    (b) Boron carbide (d) Bort

11. For smooth finish on dowels use paper—
    (a) No. 3 (c) No. 2 0
    (b) 60-grit (d) No. 3 0

Flanged Tap Wrench Takes Four Shank Sizes

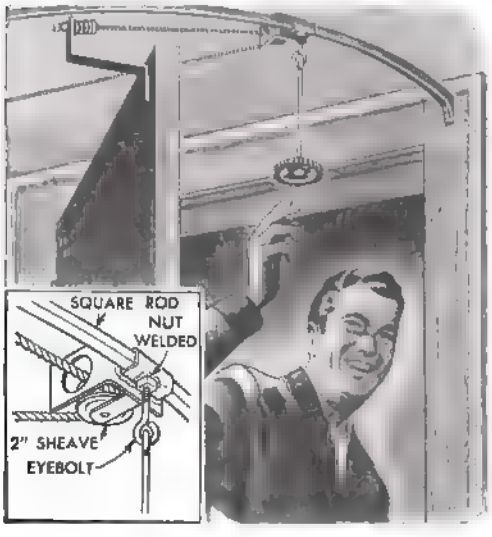


This versatile tap wrench, Fig. 1, makes an interesting and instructive project for either the home craftsman or the school shop. The handle unit is turned from ⅝-in. cold-rolled steel to the dimensions given in the detail. After knurling the ends, the center section is threaded in the lathe, as in Fig. 2, or with a ⅜-16 die. The flanges are turned from cold-rolled steel and then notched to take four sizes of tap shanks. The notches can be milled in each flange or they can be filed in the flanges by hand. If the notches are hand-filed, care must be taken to space them equidistantly. File the notches to exactly the same depth in both flanges so taps are gripped securely.



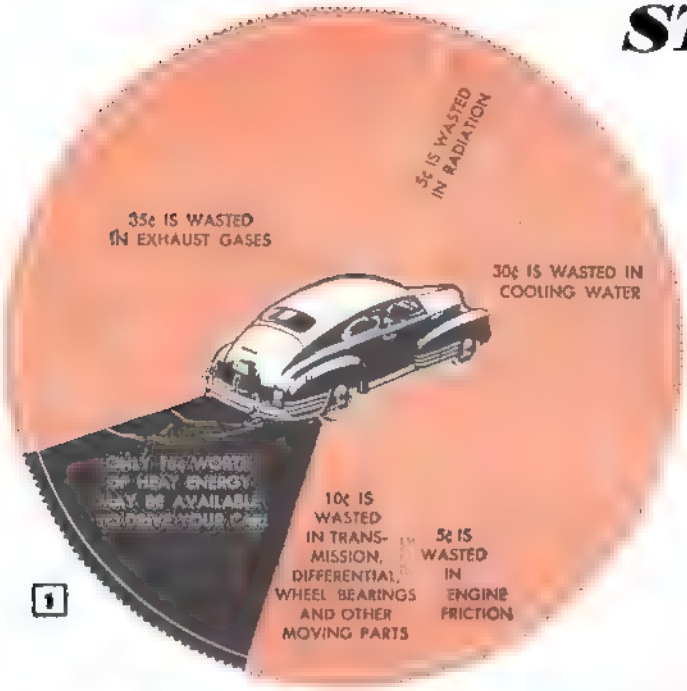
Counterweight on Door Automatically Returns It to Preset Stop

Because it was necessary to keep an entrance door partially open for proper ventilation, the workers in one powerhouse made an adjustable doorstop that runs on a circular overhead track. A counterweight brings the door back against the stop after someone passes through. The track is a length of square rod bent to a radius about 1 in. greater than the width of the door. The stop itself is made by bending a piece of flat iron to fit loosely around the track. A hole is drilled in the underside of this flat-iron sleeve and a nut is centered over the hole and welded in place. Then one side of the sleeve is welded to a piece of angle iron fitted with a 2-in. sheave as shown. An eyebolt, which serves as a setscrew to lock the stop in place, is turned in the nut by means of a steel-rod extension to which a valve handwheel is attached. A bracket bent from flat iron is fastened to the upper part of the door to take one end of the counterweight rope. This bracket may have to be offset slightly so the rope aligns with the doorstop sheave. Note that a short coil spring is brazed over the rope hole in the bracket to provide a shock absorber. Another sheave is attached to the wall at the same height as the stop and pivoted so it is always in line with the stop. A sash balance serves as a counterweight. This should slide in a wooden channel to protect the wall.



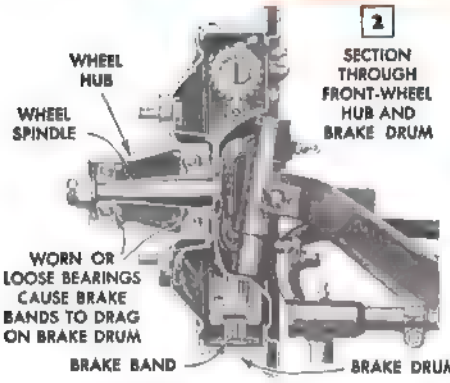
J. C. Montgomery, Bowness, Alta., Can.

STRETCH



The miles per gallon of fuel your car delivers depends not only on your driving habits, but more on how well you keep all parts of the car adjusted. That is why it is important to keep the ignition and fuel systems at peak operating efficiency, and to check the brakes, lubrication and wheel alignment to reduce rolling resistance to the minimum

Part I



Loose wheel bearings can be the cause of dragging brakes. Brake shoe contacts bottom of drum

DO YOU KNOW that only 15 cents' worth of gasoline out of every dollar spent for car fuel actually reaches the wheels in the form of power to propel the car? The remaining part of your dollar's worth of fuel is expended in friction, exhaust gases, heat radiation and cooling water. A careful study of the diagram in Fig. 1 will show how important it is to fuel economy to keep all parts of the car adjusted to give peak performance.

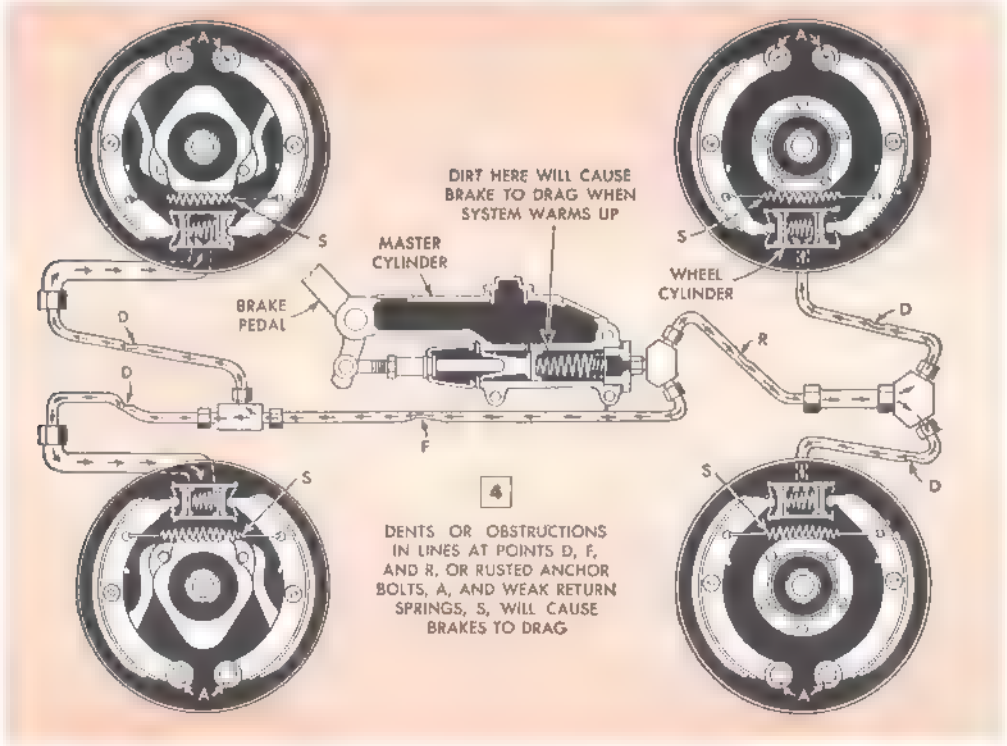
In this two-part story, C. Edward Packer, a former Service Instructor of the Ford Motor Co., will describe numerous ways the motorist can conserve gasoline by simply keeping the ignition and fuel systems adjusted correctly, and by keeping a careful check on brakes, lubrication, wheel alignment and other friction-producing parts of the car.

Normally, about 10 percent of the engine's power is consumed in the train of power-transmitting parts. Any condition which tends to increase frictional drag in any of the parts will increase the power loss proportionally. Also, a tight or loose wheel bearing, a dented hydraulic-brake line, worn brake-shoe pivots and wheel misalignment, even though slight, can cut gasoline mileage appreciably. If a wheel bearing is sufficiently loose, the bearing slack may cause the bottom brake shoe to drag on the lower part of the drum as in Fig. 2. A slight drag on all four wheels is not apparent in the operation of the car, but it can cut fuel mileage considerably. Bearings that are too tight may heat and develop sufficient drag to affect fuel economy. A flying stone thrown by the wheels or a carelessly handled jack can

dent hydraulic-brake lines. Such a dent may prevent the brake shoes from releasing fully after application. A dent in any of the lines indicated by the letter D in Fig. 4 will affect only the brake connected to that particular line, but a dent at point F would act equally on both front brakes. Similarly, a dent in the line at R would act equally on both rear brakes.

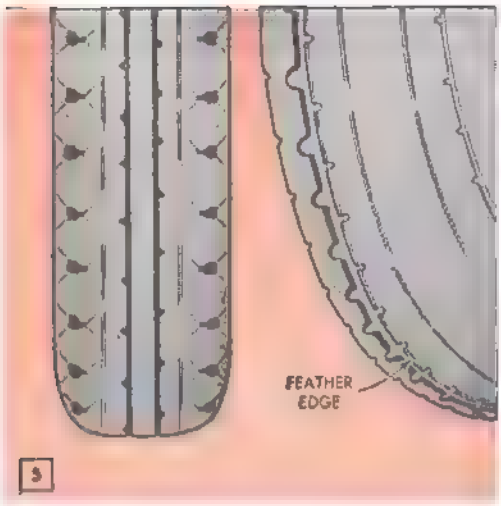
In most cases, such dents only partially impede the flow of hydraulic fluid and do not noticeably interfere with application of the brakes. But when the pressure on the pedal is released, the tension of the brake-shoe retracting spring, Fig. 4, S, is not sufficient to immediately free the brake shoes completely from contact with the drum. The release is slow, due to the greatly restricted flow of the brake fluid. During this time, the car can be rolled by hand on the level only with great difficulty. Another condition in the brake system that cuts deeply into gasoline mileage is due to dirt clogging the bleeder hole in the master hydraulic cylinder, Fig. 4. With the brake in the released position, the rubber cup on the end of the master-cylinder brake piston uncovers this hole. Then, as the car is driven and expansion of the hydraulic fluid takes place due to rising temperature, fluid moves out of the brake system and into the master-cylinder chamber above the piston. As the brakes are applied, this bleeder hole is covered as soon as the master piston moves. If the bleeder hole becomes partially clogged, all four brakes will drag on release, perhaps not enough to affect noticeably the performance of the car, but sufficient to cause a considerable loss of power. Similarly, rusted brake-shoe bolts or pivot pins, A in Fig. 4, can prevent the quick and free release of the shoes. Failure of the shoes to release also may be due to weak, broken or missing brake-shoe springs. If a car gives poor gas mileage, these are possible causes to keep in mind as they usually are overlooked when checking a car to improve mileage.

Front-wheel bearings should be washed and relubricated in the spring and fall, Fig. 3. Avoid packing the bearings with too much grease as they will be difficult to adjust correctly. When the bearing is reinstalled, the castle nut should be drawn up until the wheel begins to bind. Then the nut is backed off slowly until the wheel spins with only a very slight drag. If correctly made, this adjustment permits the

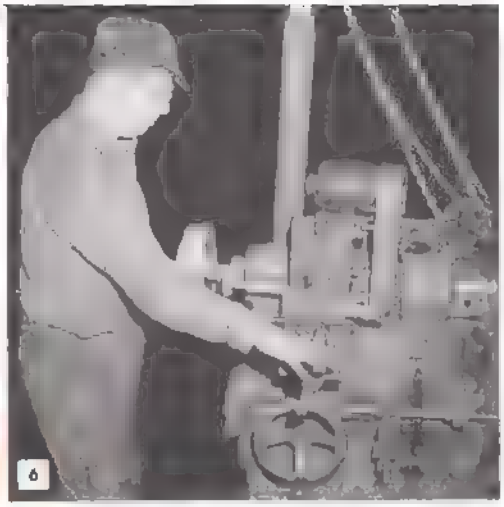


4

DENTS OR OBSTRUCTIONS IN LINES AT POINTS D, F, AND R, OR RUSTED ANCHOR BOLTS, A, AND WEAK RETURN SPRINGS, S, WILL CAUSE BRAKES TO DRAG



Misalignment of the front wheels causes rapid tire wear. Abnormal road friction requires more power



It's good economy to true up any defective brake drums; otherwise brakes cannot be properly adjusted

wheel to run with no noticeable looseness. Rear wheels, if provided with adjustable bearings, should be set up for free running with no measurable looseness. If the bearings are of the straight roller type, any up-and-down play should be corrected by replacing worn parts. Where brakes are of the hydraulic type, care must be taken when brake drums are removed not to depress the brake pedal, as this may drive the wheel pistons out of their cylinders.

Condition of the tires will reveal certain mechanical faults to a practiced eye. For example, a flat spot at only one place on a tire usually indicates a brake drum worn out of round. This can mean that the brake shoe is riding the drum at some point at each turn of the wheel. Proper adjustment of the brakes cannot be made if the drums are out of round or badly scored. Most defective drums can be restored to full usefulness on a brake-drum lathe, Fig. 6. After truing the braking surface of the drum, the shoes must be relined, either with an oversize lining or regular lining applied over a suitable shim to compensate for the enlarged diameter of the drum. After the lining is securely riveted or cemented to the metal shoe, it is ground to the exact radius of the drum as in Fig. 7. When installing the repaired parts, renew the brake-shoe pivot pins and retracting springs if these parts are damaged or weakened by rust.

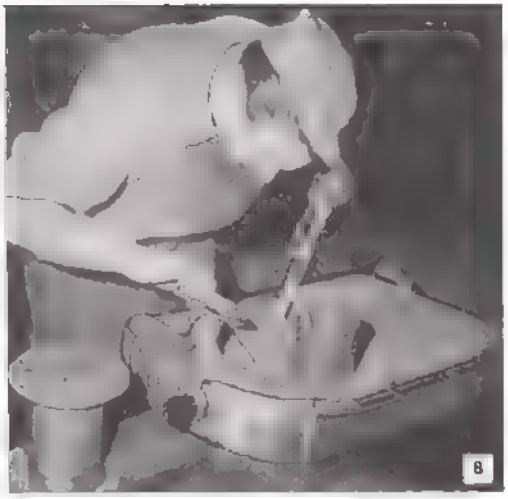
When feather edges develop along a front-tire tread as in Fig. 5, it indicates either too much toe-in or toe-out, depending on which side of the tire the excessive wear develops. The tire is not only rolling forward, but is being scuffed sideways as well. This takes a lot of power by adding to the rolling resistance. Wheel alignment should be checked periodically to avoid fuel waste and excessive wear on the tires. Driving with the tires underinflated likewise results in lowered tire and fuel mileage. Soft tires make the car ride easier, but the added road friction consumes extra fuel. The tires flatten under the load and the undue flexing of the side walls eventually breaks down the fabric on each side of the tread. Underinflated tires also heat excessively when driven at high speeds. This greatly accelerates side-wall wear. The new low-pressure tires, designed to run on 24 lbs. of air pressure, present more square inches of tread to the road, and thus carry the load at reduced pressure. However, these tires should not be used underinflated.

Wheels that dance and bounce due to the poor snubbing action of defective shock absorbers consume extra power. It is comparatively simple to keep these parts in good condition at a minimum cost by regular inspection and servicing.

Incorrect lubricants can almost double the fuel energy required to deliver power through a transmission such as that shown in Fig. 10. Relatively the same losses from this cause can also occur in the rear axle. It is true economy on the part of the car owner to see that the chassis lubricants are adapted to the car and to the change in the seasons. When refilling both the transmission and rear axle with lubricant, follow the manufacturer's recommendations.

Check the clutch-pedal clearance. The pedal should have at least ¾ in. of free movement to assure full engagement. A simple check any driver can make, Fig. 9, will show quite accurately the condition of

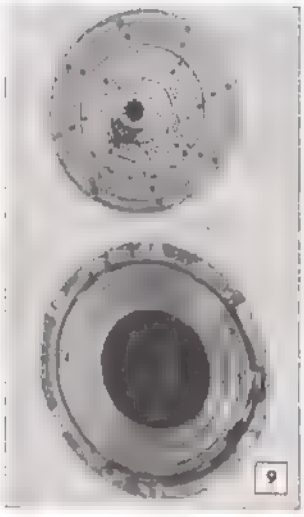
After relining, brake shoes should be ground down to the exact radius of the drum to prevent chatter



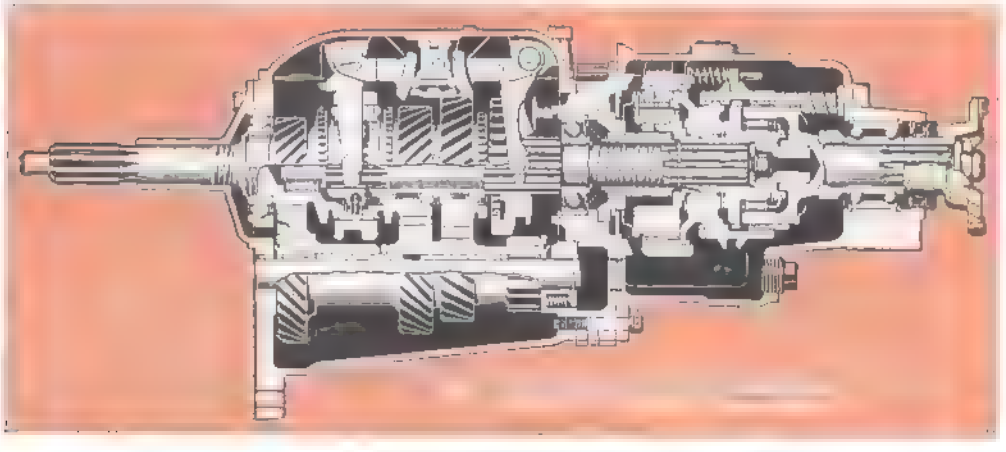
If the engine tends to overheat, clean the cooling system and solder any leaks that show under test

the clutch. Drive at 15 m.p.h. on a straight road in high gear and apply both the brake and the accelerator at the same time. Try to balance the pressure on brake and accelerator so that the car continues to run at 15 to 16 m.p.h. If, under this combined braking and acceleration, the engine suddenly breaks loose and races, it indicates that the clutch is slipping badly. If the clutch is in good condition, this procedure will kill the engine, even though the driver continues acceleration. A slipping clutch not only wastes gas, but it soon burns so that the facing has to be replaced.

If the engine temperature stays slightly above normal for any length of time, clean the cooling system. Use a good commercial cleaner and, if the car has been in use two or more years, have the radiator back-flushed after the cleaner has been removed. If this is not done, loosened particles of lime and rust may clog the small water passages in the radiator. Small leaks sometimes show up in a radiator after cleaning and should be closed by soldering as in Fig. 8. A leaky radiator may cause overheating and waste expensive antifreeze solutions.



Below, improper lubricants in the transmission and, center, a slipping clutch can cause high power losses



STRETCH

Four major parts of your car require careful periodic checks if you are to get top performance and best possible fuel economy

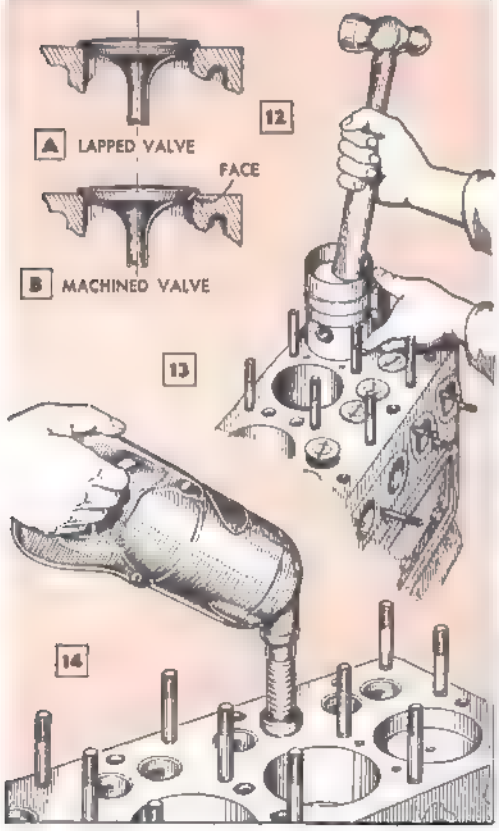
Part II

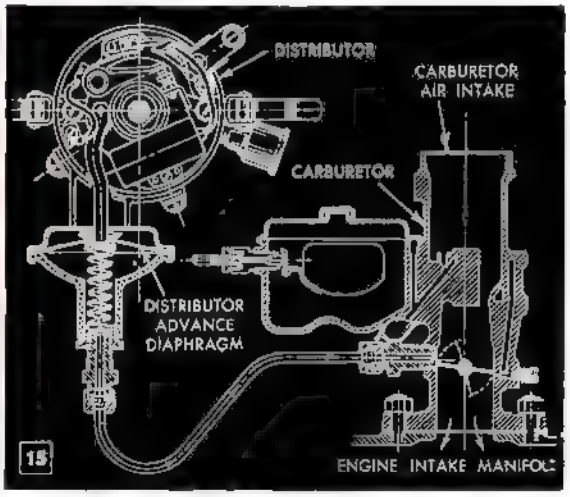
IN MAKING your car-fuel dollar go as far as possible, it isn't enough to check brakes, wheel alignment and lubrication as described in Part I. To get high operating efficiency and economy from your car, it is necessary that the service and repair schedule include the engine and the ignition, fuel and cooling systems. Servicing and repairing only one or two units and neglecting others that may need attention is not likely to make any noticeable difference in either performance or economy. It's the regular servicing of all units of the power plant that pays off in the long run.

The engine cannot operate efficiently unless it quickly warms to normal operating temperature after starting. Ordinarily, this should range from 160 to 180 deg. F. If the temperature ranges below 160 deg. F., the thermostat should be adjusted. If it runs above 180 deg. F., the cooling system likely needs a thorough check. The carburetor heater valve, generally located in the exhaust manifold, warms the fuel-and-air mixture coming from the carburetor. When the engine is cold, a maximum amount of exhaust heat is deflected to warm the incoming fuel. As the engine warms up, the bimetallic spring, one end of which rests on the anchor pin and the other in the valve shaft, causes the valve to open.

Check this mechanism often to make certain it is working properly. The com-

Checking cylinder for taper and out-of-round with a dial gauge to determine type of rings to use for repairing





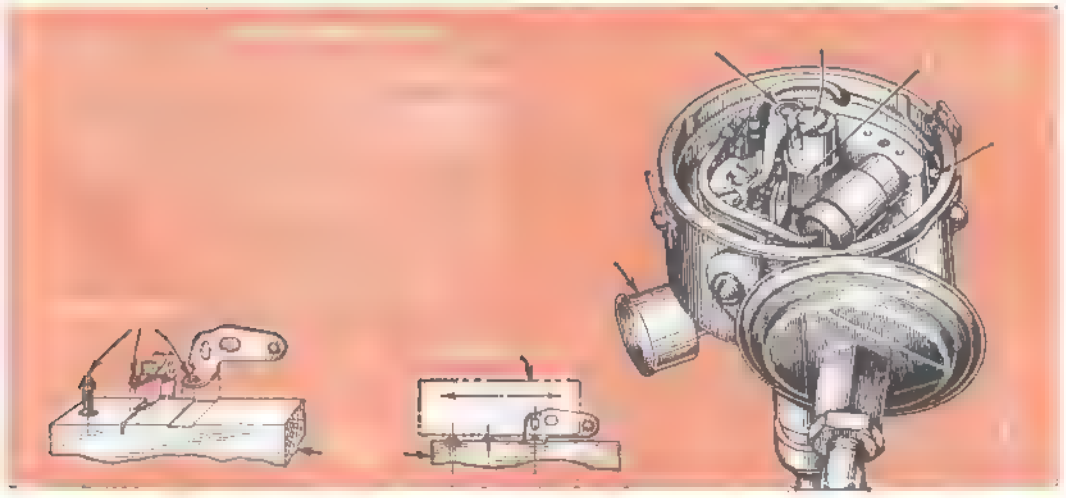
pression of all cylinders should be tested regularly and recorded. Cylinders with pressure noticeably above average no doubt are badly carboned and any that are 10 lbs. below the average pressure may have scored walls, worn rings or bad valves. Such conditions call for the removal of the head. Careful mechanics start engine overhaul with an instrument check of cylinder condition, Fig. 11. The dial gauge shows at a glance how much each cylinder bore is out of round and also records the degree of taper. If taper exceeds .015 in., most mechanics will recommend a complete reboring job. When putting in special oil rings, breakage will be prevented by removing the ridge at the top of the cylinder bore before the pistons are pulled. And, of course, a ring compressor, Fig. 13, is used when installing pistons fitted with new rings. While the engine is open, the water jackets should be flushed out.

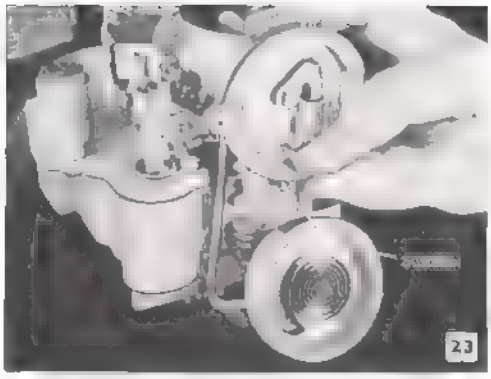
Having the valves refaced and reseated, Fig. 14, usually results in greatly improved gasoline mileage. Fig. 12, detail A, shows a valve with a groove worn in the face. If such a valve is "lapped in" with the engine cold, it may not seat properly when engine temperature rises. The valve face should be machined as in Fig. 12, detail B, and the seat in the block renewed by grinding.

A worn timing chain causes what mechanics call "valve lag"; that is, the intake valve opens after the piston passes top dead center on the intake stroke. This creates a partial vacuum inside the cylinder that tends to pull oil past the piston. Many stubborn cases of oil pumping are traceable to a worn timing chain.

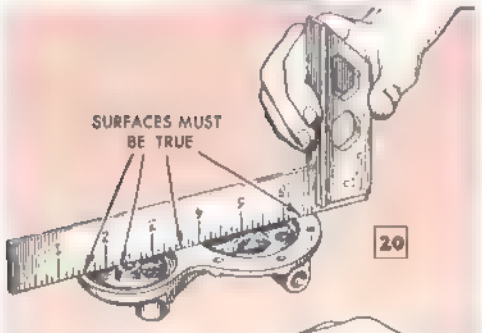
With the engine in good mechanical shape, the ignition generally is rated next in importance in a thorough tune-up. If a spark plug "oils up," it often means that it is running cold. Install plugs of the correct heat range. Sometimes the high-tension wire to the oily plug is in bad condition or making poor contact. Replacing the wire often cures the trouble. If the inside of the distributor cap shows evidence of arcing and is dirty or cracked, it will pay to install a new one. On some distributors there are five places, Fig. 18, that need lubricating at regular intervals. The grease cup, A, should be turned down regularly. Also, place a drop of oil at B every 1000 miles. An occasional smear of grease applied to the breaker cam, D, will prolong the life of the fiber bushing. At 5000-mile intervals, a drop of oil applied with a toothpick at C is desirable. And, at the same time, a drop of oil on the ball bearings of the advance mechanism, E, is recommended. A typical vacuum spark-advance mechanism is shown in Fig. 15. The importance of proper spark advance in efficient engine operation is illustrated by the ignition timing-advance curve in Fig. 16. The straight arrow at the bottom indicates the spark advance in degrees as engine speed and power increase.

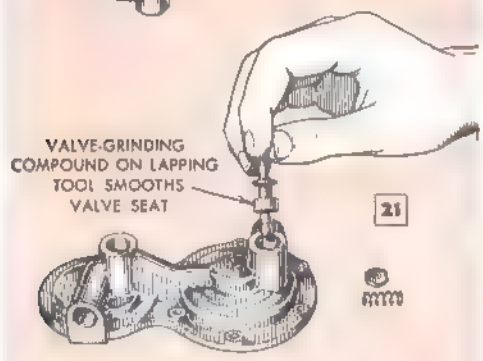
Although burned breaker points should be replaced, those only slightly pitted can be removed from the distributor and resurfaced with an oilstone as in Fig. 17. Mount the points on a block of hardwood and groove the block to support the bracket firmly. If the ground point is of the screw type, a hole should be drilled in the wood to receive the threaded end in a tight fit. The distance that the points open in any

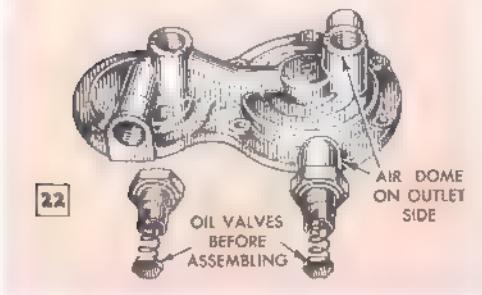




Above, checking screen in choke-control heater. Left, testing fuel pump. It should lift fuel 30 in.





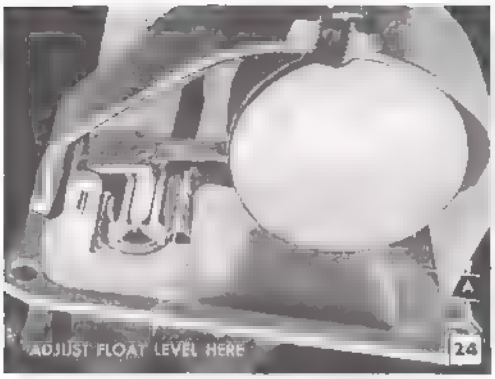


particular distributor determines the cam angle. If there is any doubt about the correctness of the cam angle, have the mechanism checked on a precision tester.

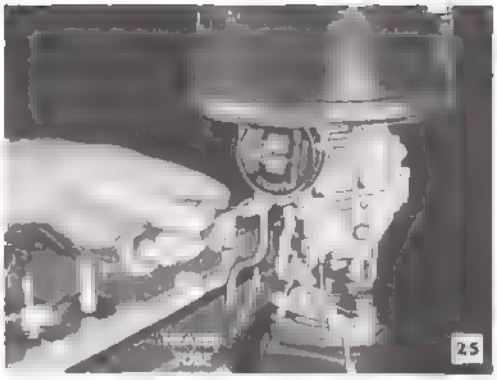
Complete service kits for most fuel pumps and carburetors can be purchased from auto-supply dealers. When overhauling either of these units, lay the parts out in order on a tray. Then the new parts from the repair kit can be substituted for the old ones as the unit is rebuilt. In servicing the fuel pump, a very important check is made with a straightedge to see that the joining surfaces of the housing are true, Fig. 20. If only slightly distorted, they may be made serviceable by rubbing them on a sheet of coarse emery cloth.

Fuel-pump service kits include diaphragms, and these should be soaked in kerosene before assembling. See that the holes are correctly lined up and held in alignment while tightening the diaphragm nut. Also, see that the glass sediment bowl makes a gasoline-tight contact with the gasket. New valves should be used in rebuilding the fuel pump. Always examine the valve port to see if the brass valve seat is smooth. If not, a lapping tool, Fig. 21, coated with valve-grinding compound will restore the seat. These seats, in many cases, are small brass rings, and can be forced out of the pump casting and replaced. When building up the valve assembly, the parts should go in the order shown in Fig. 22. The composition valves lie flat on the brass seats, the springs bear on the valves and the port plugs are tightened firmly in place. The airdrome type of port plug must always be on the outlet side of the pump to equalize the fuel-pump pressure and to prevent surging.

Complete carburetor repair kits are available for the common later types. Carburetor jets can be removed with a screwdriver, but the sides of the blade should be ground as in Fig. 26 so that the threads in



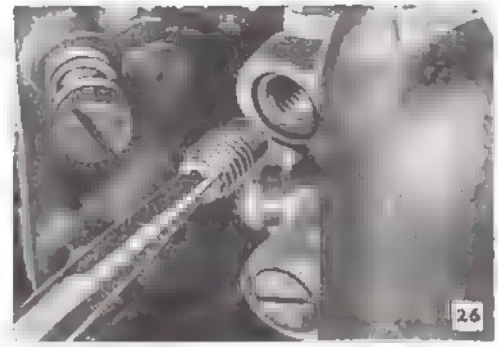
Carburetor-float level, A, is adjusted by bending the float arm. Consult instruction book for dimension



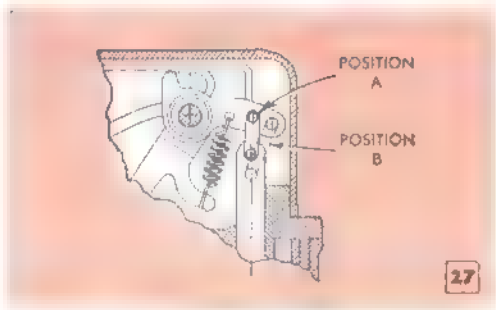
Remove choke-heater tube and blow out with compressed air to make sure it is not clogged with carbon

the carburetor bowl will not be damaged. After disassembling, wash all passages and clean the parts with alcohol or acetone to remove any gum deposits. Then blow out the passages with air from a tire pump. Using a jet one size smaller than standard saves fuel. When inserting the leather accelerator plunger, a feeler gauge can be used to help slide this part into place. In Fig. 24, A indicates the float level which is adjustable by bending the float arm. Just how and where the arm is bent, and what the dimension A is, will vary in different cars. Consult instruction data. When assembling the carburetor, all plugs below the gasoline level should have the threads lightly coated with shellac before being installed. With the carburetor installed on the car, the engine should be warmed up thoroughly and the low-speed idle adjustment set so the engine just "ticks" over. The mixture adjustment should be as lean as it can be set without having the engine die or pop back through the carburetor when accelerating. One method of adjusting the length of the accelerating-pump stroke is shown in Fig. 27. With the linkage in position A, pump movement is at a minimum. For more powerful acceleration and cold-weather performance, the linkage is changed to position B.

Some types of automatic chokes depend for operation on the heating of a coiled bimetallic spring, Fig. 23, to open and close the choke valve. Sometimes the screen over the end of the heater tube, Fig. 23, becomes clogged and cuts off the flow of heat. This lack of heat causes the valve to be held in a semichoked position, wasting a great amount of fuel. The heater tube, Fig. 25, running from the exhaust manifold to the control should be checked to be sure that it is not clogged. Automatic chokes have a winter and summer setting which should be reset at the end of each season, following manufacturer's directions.



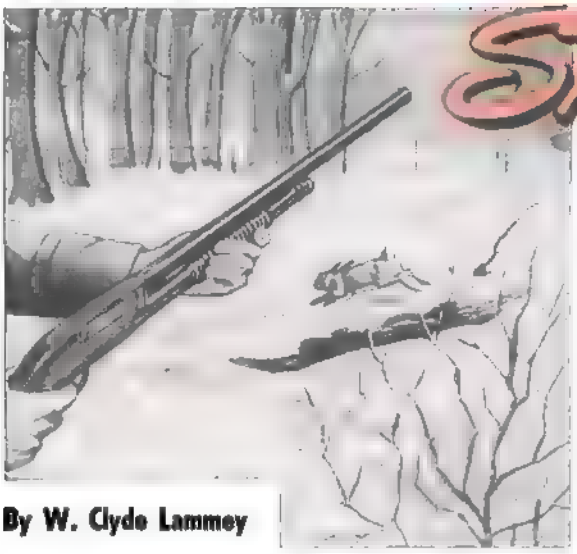
When removing the carburetor jets, grind the screwdriver blade to prevent damaging the fine threads



Accelerating-pump linkage has two settings, A and B. The former gives best economy with slow acceleration

Compressed Air Helps Rewire Car

After several futile attempts to pass a wire through a channel in a car body, one mechanic hit upon the idea of using compressed air to do the job. First, he tied a small piece of cloth to the end of a length of string and placed the cloth in the channel. Next he blew the cloth through the channel with a jet of compressed air. Then the other end of the string was tied to the wire to permit pulling the latter through the channel.



Shotgun

By W. Clyde Lammey

WHEN quail rise from nearby thickets and streak away through the low cover, or a cock pheasant blasts unexpectedly into the air from a spot almost under your feet, you'll find it easy to agree with those experienced shooters who have called shotgun pointing a sport of "controlled relaxation." That's just what it takes—a delicately controlled coordination of feet, legs, shoulders, arms, hands, head, eyes and senses. Each mental and physical process must be assigned a definite place in a smooth continuity of motion, all to the end of accomplishing several specific things in a split second of time. Like other outdoor games requiring a high development of skill and dexterity, it calls for a lot of practice. When flushed birds are winging away at mile-a-minute speeds there's no time to take into deliberate account all the variables offered by each shot. Essentially the problem is simple—mainly that of intercepting one moving body, the target, with another, the shot charge. But suppose you are standing in the open and, without warning, a flying target suddenly appears, moving across in front of you from left to right at a speed of say 88 feet per second, or about 60 miles per hour. Some game birds fly even faster. How to place a shot charge at just the proper distance and posi-

① Beginning of the gun swing in firing at a target crossing in front at right angles from left to right. Note that the shooter first swings left to pick up the target, using the gun as a "pointer"

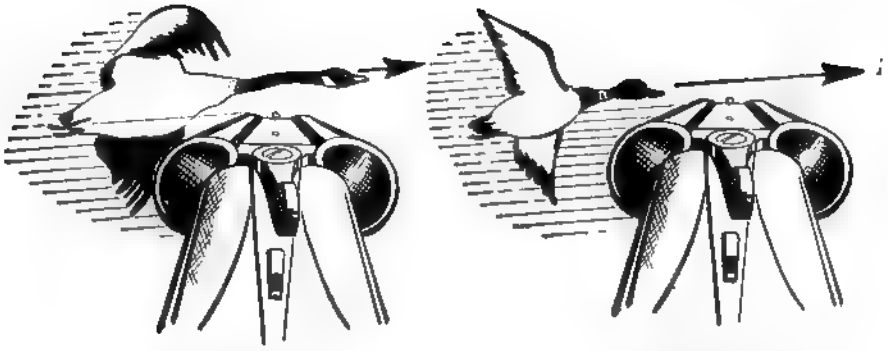
② Here the shooter starts the reverse swing, the pivot to the right continuing until after the shot is fired so that speed of gun swing will not diminish. Note that feet remain in the same position

Footwork

tion in the sky ahead of this speeding target to catch it when it comes along—that's the trick.

It begins with footwork. If a shooter is caught off balance at the instant his target is trapped, or has the wrong foot forward when a bird flushes in the field, he's almost sure to miss, unless he's practiced approved methods of getting quickly into shooting position. Many grouse hunters move through likely cover with a short, halting step and gun held in both hands. Experienced quail shooters, moving in for the flush behind dogs holding rock-steady on point, do much the same. Each must have his feet "under him," ready for quick, controlled action when the birds take off.

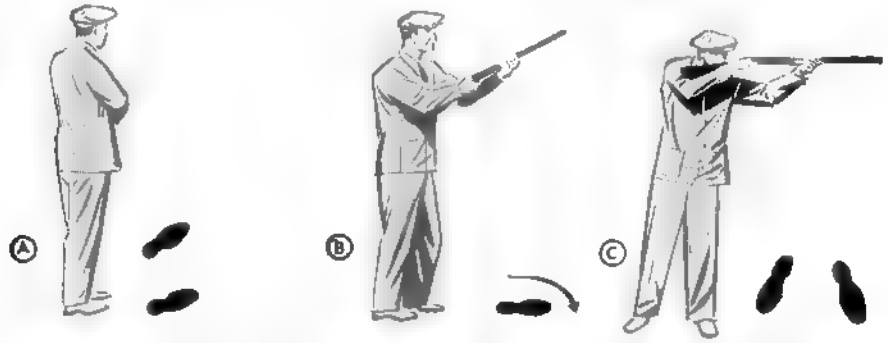
If all the variables of any given shot are calculated mathematically and the necessary impulses and body movements are considered separately, the thing can be made to appear impossible. But the answer to that one is that a single mental process can be trained to control several physical reactions which may be required to produce a definite result, just as in driving a car or playing golf or tennis. At the outset the shotgun pointer acquires the habit of "facing the shot." If he's a right-handed shooter he comes to think of the right leg as the balance or "steering" leg. His left leg becomes the "pivot" leg. In



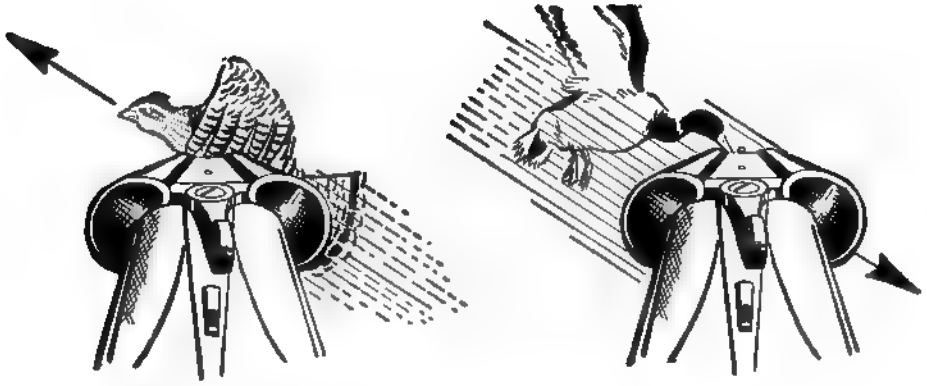
trap, skeet and upland game shooting the feet normally are kept quite close together. Irregularities in posture, such as feet spread wide apart, bent knees, or body bent far forward, destroy the muscular torsion and body balance so necessary to a quick, rhythmic swing to right or left. In facing the shot the left toe usually points slightly to the right of the spot where it is expected the shot charge will be delivered. The feet are separated at an angle, the right foot normally a few inches back of the left. Nearly everyone can take this position, raise, or mount, the gun and swing it right or left through a combined angle of 60 degrees or so without experiencing undue muscular tension or discomfort and without lifting either heel from the ground. In this position most of the weight will be on the left foot. When a swing is made in either direction, muscles of the feet and legs will be placed under a torsional strain which increases progressively until the extremes are reached. The gun muzzle is lowered to follow running game by bending the body forward at the hips, raised by a slight backward bend and swung right or left by pivoting, not swaying. Arms, head, torso and gun move as a unit, except that in a swing from left to right, right-handed shooters may find it necessary to slide the cheek along the comb of the gunstock. In depressing the muzzle the left leg takes more of the weight, while in elevating the gun the right takes the greater share. However, in a good shooting position the transfer of weight is hardly noticeable.

Body and foot positions in Figs. 1 and 2, A to F inclusive, show in ■ way how the whole procedure works out in practice. The broken line shows the approximate position of the gun in relation to the foot position. Some good shotgunners stand with the feet even closer together than indicated, while others, especially skeet shooters, find it more to their advantage to stand with the feet somewhat farther apart. There are no hard-and-fast rules but in any case when facing the shot the feet are the foundation from which the gun swing is made and both should be firmly on the ground during the whole maneuver.

Watch ■ top-rate wingshot take the four pairs of doubles in a round of skeet, where the traps are sprung simultaneously, and the shots usually are taken from stations



This shotgunner is taking a surprise target flying away sharply to the right. He must withdraw the right foot, pivot on the toe and step in the direction of the flying target with the left foot



RISING TARGET

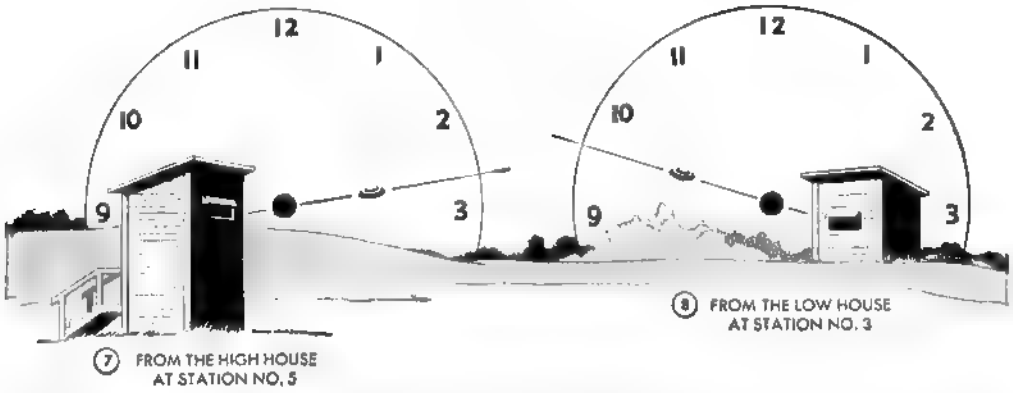
FALLING TARGET

⑧

1, 2, 6 and 7. In the ready position the shooter faces the shot on the near side of the spot where the targets will cross in flight. In this way he has his feet already placed in the best position to swing on the second bird. He takes the outgoing target first, then swings for the incomer from the same foot position. Also, if you observe closely you will see that the gun swing doesn't start at the precise instant the targets are trapped, but that the shooter holds for the briefest moment until the targets are in clear view. Then, like the golfer, he must have perfectly controlled coordination, but he must move a lot faster.

In this demonstration two things take place that you don't see. In order to estimate instantly the apparent speed and direction of the swiftly moving targets, the shooter very likely is using the imaginary vertical clock system, Figs. 7 and 8, and, to bring the gun to bear on the flying clay birds before they get out of bounds, he must cut his timing pretty thin. There's no time to swing the gun in front of each individual bird and maintain a measured lead. So the shooter uses a trick effective at the shorter ranges and known to shotgun pointers as the fast swing or "swinging-past" method, Fig. 3. In this the gun muzzle follows the line of the target's flight in a fast swing, overtakes it from behind and swings past. As the gun muzzle passes the target the shooter pulls the trigger, and the gun, swinging faster than the bird, builds up the required lead. The essential thing is that the gun be moving uniformly. Any irregularity in the swing, such as flinching or stopping the swing at the instant the trigger is pulled, likely will cause a miss. Speed of the swing is important, too. For example, the speed of the swing in a crossing shot must vary from that employed in a quartering shot. Practice of the fast-swing method usually is to be recommended only for the shorter ranges where flight of the targets is uniform and predetermined, such as in skeet or certain shotgun games and also in upland game shooting where the nature of the cover and the character of the bird's flight call for quick work at close range. Some wild-fowl hunters using high-speed ammunition use the fast swing at medium-long ranges. On the other hand, at the traps, pass shooting, or along game-bird flightways where the

⑥ **Caught out of position with the right foot forward and the target flying to the right rear, the shooter throws his weight on the right leg, pivots and swings the left foot to face the target**



(7) FROM THE HIGH HOUSE AT STATION NO. 5

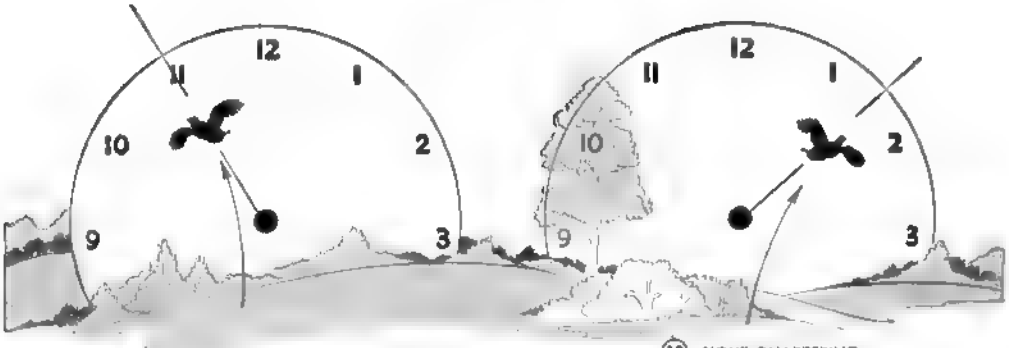
(8) FROM THE LOW HOUSE AT STATION NO. 3

shots are taken at comparatively long ranges, good shooters generally use what is known as the slow swing or "pointing-out" method, Fig. 3. This involves a more precise calculation of distance, apparent speed of flight and gun swing. Actually the eye controls the whole procedure. Here the gun is swung ahead of the bird and a measured lead maintained until after the shot is fired. In this the apparent speed of the target is important. A target crossing in front of you at right angles and another quartering away either right or left may be moving at the same rate of speed but the quartering target will appear to be moving much slower. This is due to perspective, or obliquity of the line of flight to the eye. Because of this apparent reduction in speed the forward allowance or lead will need to be reduced accordingly. All this assumes that the target is maintaining a more or less level flight. Sharply rising or falling targets, Fig. 5, introduce another factor. You have to lead a rising bird above as well as ahead. To connect with a falling target you have to get well under it. Figs. 3 and 5 are merely approximations. The sketches do not represent actual leads.

Most right-handed shooters find it easier to swing on a target crossing from right to left than on one from left to right. Often it will take considerable practice with the gun before one can accomplish the maneuver with equal facility in either direction. If you're a right-handed shooter, it's a good idea to practice the left-to-right swing shown in Figs. 1 and 2, details A to F inclusive. This can be done anywhere there is room to swing the unloaded gun. Keep the feet in the same position during the whole maneuver. Such practice, "dry shooting" as it often is called, is a valuable aid in mastering the finer points of gun swing and coordinated footwork. Left-handed shooters will find it extremely helpful to practice a right-to-left swing in the same manner.

Fig. 4 illustrates a surprise situation where the shooter is moving through cover in the field. As the bird flushes and makes away well to the right and toward the right rear, the shooter's left foot is forward as at A. He must shift the right foot, pivot on the right toe and step in the direction of the flying target with the left foot as at B. Then by a third movement he comes to the position shown at C with the gun raised to point out the bird. Note that in this maneuver swinging and mounting of the gun and the footwork are done simultaneously. Fig. 6, A, B and C, shows much the same thing as Fig. 4, with one important variation. In this case, the shooter is taking a surprise shot to the right while advancing at a normal pace but caught out of position with the right foot forward when the bird gets up. The shooter finishes the step as at B, then pivots on the right foot and brings the left foot into position as at C. The foot positions in Fig. 6, C, have purposely been shown slightly incorrect to illustrate what often takes place. In making a quick pivot of this nature the tendency is to place the feet directly opposite whereas the left foot should be farther forward for good balance. Some practice may be necessary to correct this tendency. The maneuvers shown in Figs. 4 and 6 are among the most difficult foot movements for the upland gunner on uneven ground, or at the various "walk-up" gun games where the shooter must fire at surprise targets thrown at unknown angles. Practicing these foot movements for surprise shots from both the right and left will be a help in field shooting.

Use of the imaginary vertical clock face in applying method to the business of pointing a shotgun is quite simple in both theory and practice. In skeet or trap shooting the clock-face zero, represented by the

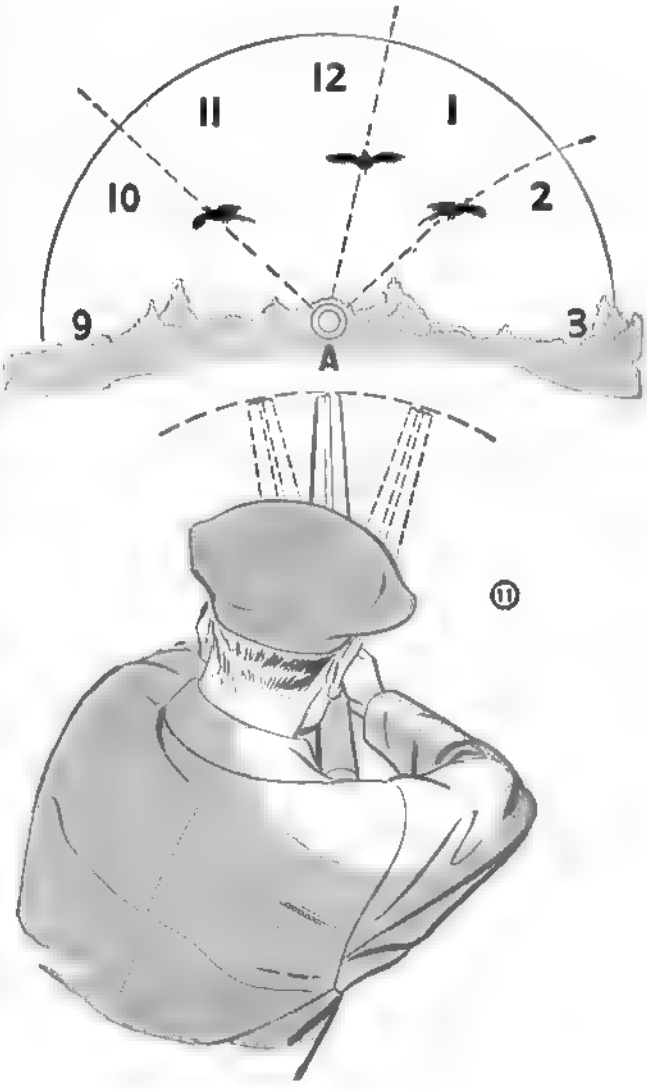


⑨ LEFT QUARTERING RISE

⑩ RIGHT QUARTERING RISE

solid black circles in Figs. 7 and 8, will be the point in space near the trap house where you expect the target to appear in clear view. Once the target is sighted clearly, it's easy to think of it as a "2-o'clock" shot, a "2:30-o'clock" shot or a "9:30-o'clock" shot, depending on where the apparent line of flight will cut the circle of the imaginary clock face. When you face the shot at that point where you expect the target to appear, it takes only a comparatively short swing to put the gun on either a 10-o'clock or a 2-o'clock bird. This will be more clearly seen from Fig. 11, the zero point A representing the point at which the bird was first sighted. In upland shooting at birds which rise from cover, the zero point of the clock face can be thought of as being only in the vicinity of the spot where the bird was first sighted, as in Figs. 9 and 10. If you accustom yourself to its use, the clock face will form in your imagination the instant you recognize the flushing bird as a legitimate target.

In the 11:30-o'clock or 12:30-o'clock shot, Fig. 11, the lead and swing are reduced almost to zero, gun movement merely compensating for the rise of the target. In addition to footwork the shooter should consider stock length, drop, pitch and barrel boring to suit his purpose.

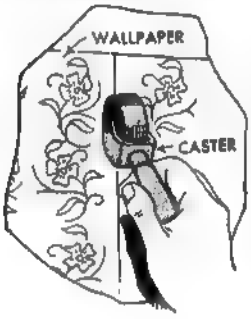


⑪

Rolled Paper Soaked in Paraffin Kindles Outdoor Fire in Light Rain

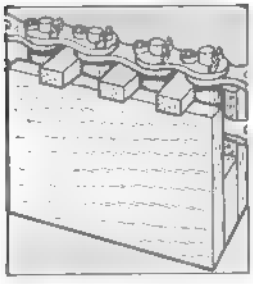
Did you ever find yourself badly in need of a fire when miles away from the nearest shelter, and discover that although the matches were dry, there was no dry wood available? At times, such a situation could have serious consequences, and for this reason, it's an excellent idea to carry several fire rolls on every hunting or fishing trip. These fire rolls are easy to make and their cost is negligible. Just fold a few sheets of newspaper four times and roll them up tightly. Fasten the rolled paper with pieces of light wire spaced an inch or two apart along its length. After cutting the paper into 3-in. rolls, soak it in paraffin melted in a double boiler. Then, remove the rolls from the paraffin and allow them to harden. Place a couple of these rolls in your hunting-coat pocket or tackle box, and when you need a fire in a hurry, pile small twigs and larger branches over one of the rolls and light it. The resulting hot flame, which burns for 5 minutes or more, will ignite the twigs easily. The twigs will dry and ignite the branches, giving you a good fire even in a moderate rain. If the twigs are very wet, use two fire rolls.

Improvised Wallpaper Seam Roller

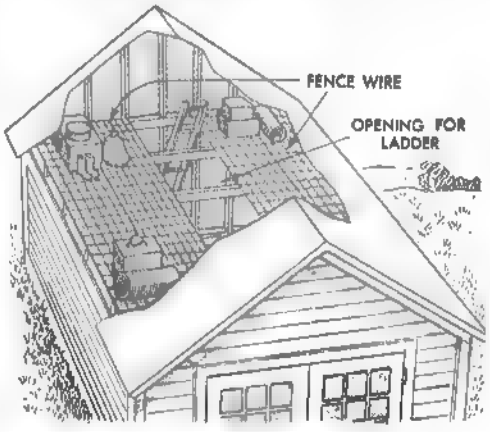


When wallpapering a room and a seam roller is not available, an ordinary caster makes an excellent tool for this purpose. The caster is easier to manipulate if fitted with a handle taken from an old file or other tool.

Removal of Roller-Chain Pins Simplified by Repair Block



The pins of bicycle and motorcycle roller chains are removed easily without straining the links or rollers if the chain is mounted in a repair block made of hardwood scraps. The block consists of two side pieces fastened to a center piece, allowing enough room below the chain for the pins to be driven out. Small wooden spacer blocks are slipped between the rollers to hold the chain in position. All of the blocks must be the same thickness in order to keep the rollers and links parallel.



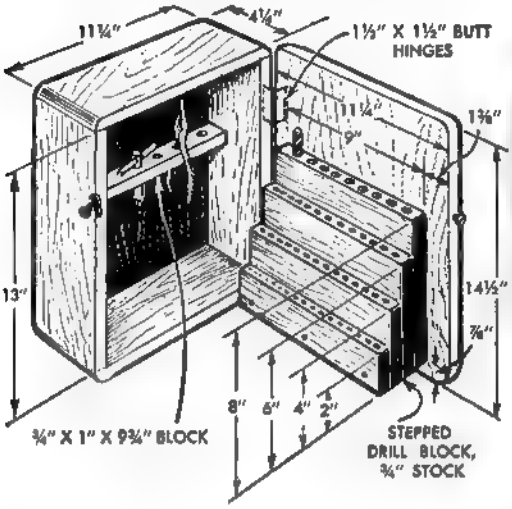
Fence Wire Used as Floor In Garage Attic

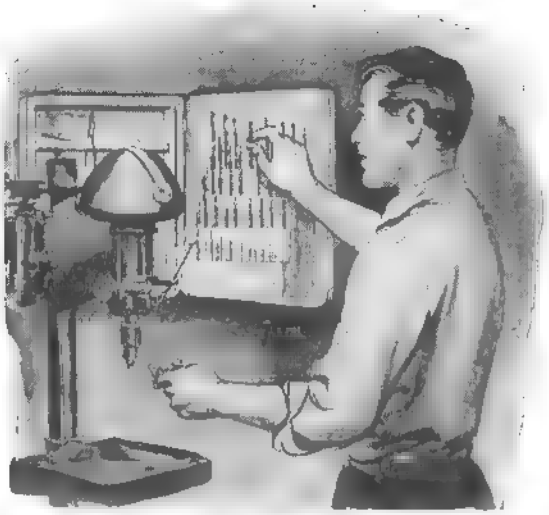
Besides being cheaper than wood flooring, I found that wire fencing made an excellent floor for the attic over my garage as it not only prevented dust and dirt from collecting, but also afforded a view from below of the items stored. I left the center unfloored for access by ladder.

George W. Horres, Charleston, S. C.

¶Place a baked potato in a breadbox to keep the bread from drying out. Also, wash and air the box once a week to keep the bread from having a musty taste.

Wall Cabinet Contains Stepped Drill Rack



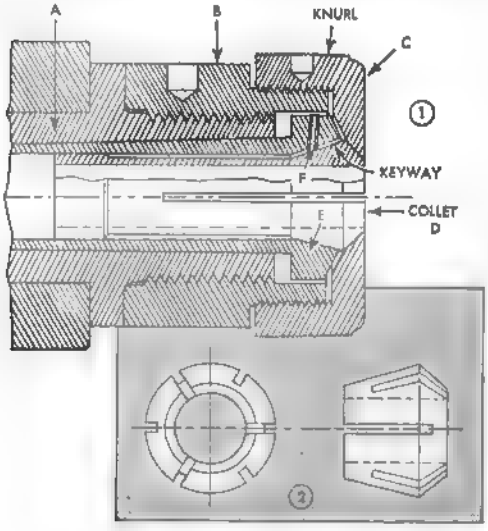


Mounted within easy reach of the drill press, this handy wall cabinet keeps an entire set of drills available for immediate selection. Both cabinet and drill rack are made of ¾-in. white pine, the rack consisting of four blocks of wood of increasing width fastened to the inside of the cabinet door. A shelf across the back of the cabinet holds wrenches, micrometer and other necessary tools. The drills are stored upright in blind holes drilled in a row along the top edge of each block, each hole being made with a drill of the next size larger than the one the hole is to retain. After the blocks have been drilled, the holes are labeled appropriately and the blocks are nailed and glued together as shown. Then they are attached to the cabinet door in the same manner. The door is hung on butt hinges and is held closed with a hook or with a hasp and padlock.

Dick Hutchinson, Alhambra, Calif.

Collet Chuck Is Compressed by Knurled Cap Instead of Draw Rod

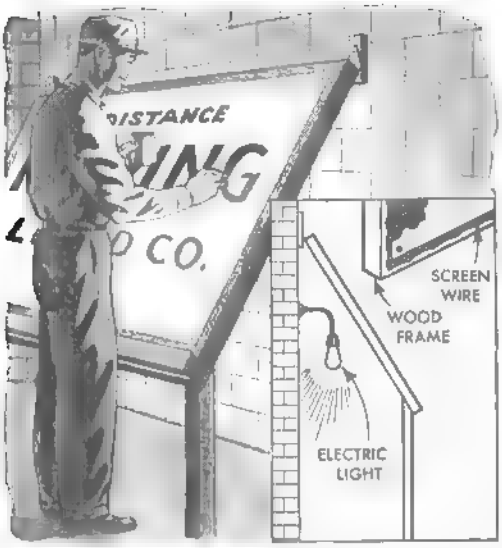
Here's a collet chuck that differs from the draw-in type in that a knurled cap instead of the draw rod usually employed compresses the collet. It also has the feature of admitting larger collets. The lathe spindle, part A, first is fitted with a hardened and ground taper sleeve, part E. Next, part B is machined and threaded to fit the lathe spindle, after which the part is drawn up tightly against the shoulder of the spindle with a spanner wrench. The outer end of part B has a fine thread for a knurled cap, part C. Note that the hole in the cap is beveled on the inside to match the taper on the front end of the collet, Fig. 1. Pressure at this point, when the cap is tightened, causes the collet to grip the work. A pin, part F, pressed into part E, prevents the collet, D, from turning. If a lathe does not have a hollow spindle, the chuck can be adapted for use by lengthening part B and using the short collet shown in Fig. 2. In this case, of course, only short work could be held in the chuck.



Wm. E. Helsel, Grand Rapids, Mich.

Pipe-threading compound brushed on the teeth of a hacksaw increases the cutting speed of the blade and prolongs its life.

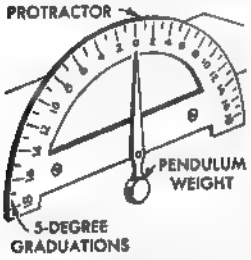
Shadow Screen for Copying Speeds Painting Signs



With this shadow screen, any number of duplicate paper or cloth signs can be hand lettered quickly from a master pattern. It consists of a wooden frame which is covered with screen wire and then hinged at a convenient slant to a wall. A large light bulb illuminates the screen from behind. In use, a master pattern of the sign is made and thumbtacked to the screen wire. Then, the cloth or paper sign material is placed on top of it. When the light is turned on, the lettering of the master pattern will show through from the back in silhouette outline, making it an easy job to copy.

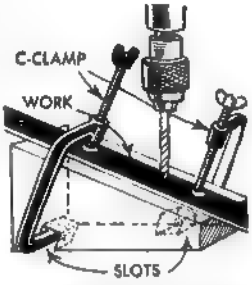
Otto Woolley, Colorado Springs, Colo.

Gradometer Made From Protractor



Here's a way to make a simple gradometer for measuring the incline of grades and slopes, and determining the fall of short runs of drain tile, water pipe and open ditches. Obtain a draftsman's metal protractor, turn it over on a flat surface with the graduated side down. Next, lay off and mark ■ new set of graduations 5 deg. apart and number each mark as shown to represent the number of inches of rise per foot. Fasten ■ weighted metal pointer at the center index mark of the protractor, using a hollow rivet peened lightly so that the pointer will swing freely. Screw the protractor to a mason's wooden level in such a position that when the spirit bubble shows level, the swinging pointer registers exactly zero on the protractor scale. Each 5-deg. division on the scale indicates an incline of approximately 1 in. to the foot. This is accurate enough for average work.

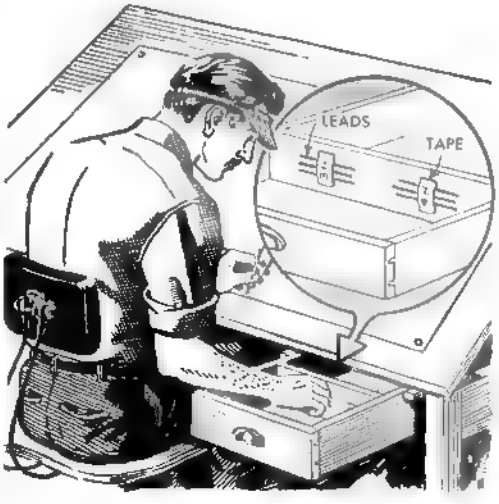
Drill Vise Takes Place Of Nontilting Table



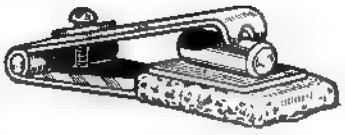
Where it is necessary to tilt the work on a nontilting drill-press table, a simple work holder consisting of a wooden angle block fitted with two C-clamps will permit angle drilling. The block is angle-cut to correspond with the angle of the hole to be drilled, that is, to drill a hole at a 60-deg. angle, the block must be cut at a 60-deg. angle. Notches in the block recess the clamp pads so that the block will set flat on the drill-press table.

Short Pencil Leads Salvaged To Use in Compass

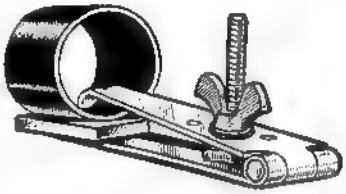
Many draftsmen salvage short pencil leads for use in their compasses or bow pencils. A convenient way to keep these leads at hand is to attach them to the tacky surface of a strip of adhesive tape, which is fastened to the side of an equipment tray or drawer. Before attaching the leads to the tape, sort them according to degree of hardness and then write the hardness number on the tape.



SMALL CLAMPS from HINGES

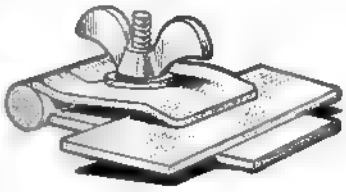


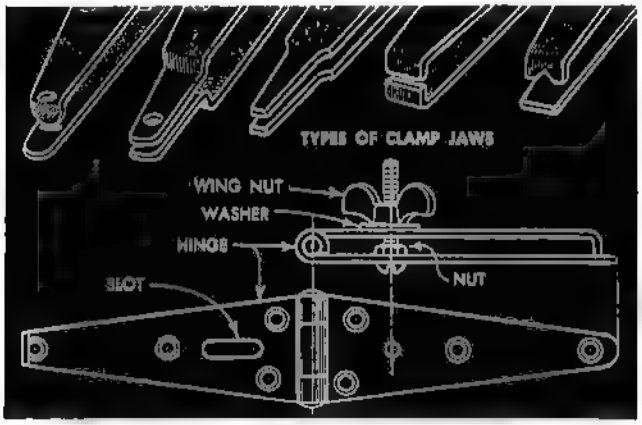
Hinges need not serve only as hinges. They can be put to work as efficient clamps. Ideal for holding small work in position for soldering and light brazing, they are especially useful where the nature of the work requires a clamp having narrow jaws and a deep throat. Modelmakers will find these clamps just the thing for holding odd-shaped work, as the ends of the jaws can be bent and shaped to fit the exact contour of the parts to be glued or soldered. The four examples show various applications of hinges for clamping small work.

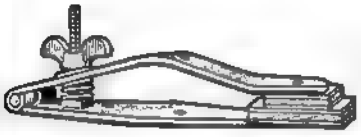


Strap hinges make the best clamps. The drawing below shows a typical clamp and also a few of the many different types of jaws that can be formed. A wing nut, washer and stove bolt provide clamping pressure. The bolt is placed in a hole drilled in the hinge leaf and the head is backed with a nut. A slot formed in the other leaf engages the end of the bolt and permits opening the clamp jaws. The amount the jaws can be opened is determined by the length of the slot. A small coil spring placed over the bolt between the leaves of the hinge will provide a clamp with self-opening jaws. When a clamp is used to hold parts to be brazed, the parts should be clamped to an asbestos pad.

Edward J. Thatcher, Woodstock, N. Y.

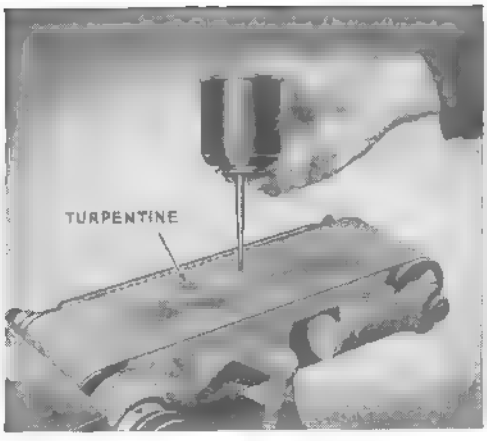




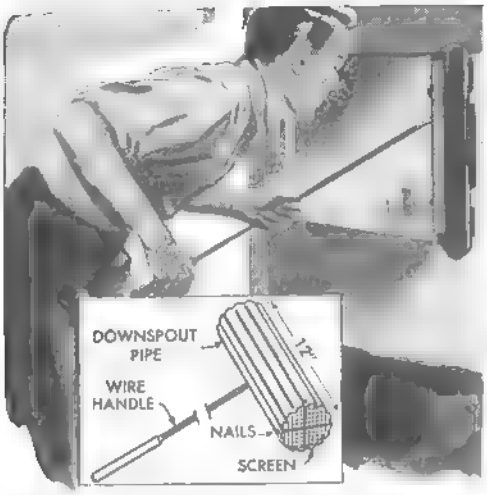


Turpentine Softens Glaze On Sanding Belts

When a sanding belt or disk becomes glazed to the point where it no longer will cut, don't throw it away. You can get further use from it merely by removing the glaze with turpentine. First, soften the glazed areas with the turpentine and then remove the deposits with a wire scratch brush, being careful not to rub too hard so as to wear away the abrasive. An oilcan makes a handy applicator and container for the turpentine. Fast evaporation of turpentine permits the belt to be used almost immediately. Caution: Do not turn on the sander to speed the removal of the glaze, as sparks might ignite the turpentine.

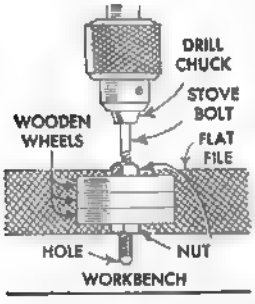


"Fire Tube" Aids Starting Fire In Stove or Furnace



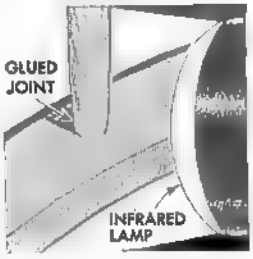
If your stove or furnace smokes due to a cold, damp chimney when a fire is started, you can prevent it by preheating the chimney with this "fire tube." By doing so, a draft is created in a short time which draws the smoke up the chimney. The fire tube is made from a 12-in. length of downspout pipe, one end being fitted with a grate of screen wire held by two nails fitted crosswise as shown. A length of stiff wire is attached for a handle. To use the fire tube, place a handful of kindling in the tube and ignite it through the bottom, hold the fire tube inside the stove or furnace and near the smoke pipe. Then when the fire in the tube burns briskly, dump the contents onto a bed of wood and coal previously made and the fire will take hold quickly. It is best to form a small hole or pocket in the kindling bed to keep the fire concentrated.

Wooden Wheels for Pull Toys "Turned" With Hand Drill



Not having a lathe to turn some wooden wheels for a pull toy, I used a hand drill to turn them. After sawing the disks as closely to line as I could, I drilled a hole through the center of each one and mounted the disks on a bolt, tightening them together with a nut on each side. With the bolt clamped in the chuck of the drill, and a hole drilled in the workbench to serve as a bearing for the end of the bolt, I had another person hold a flat file against the edges of the disks while I rotated them with the drill. When the file was held on edge and pressed squarely, but lightly, against the work, it was possible to produce neat little wheels by hand.—Chester Wathey, Philipsburg, St. Martens, N. W. I.

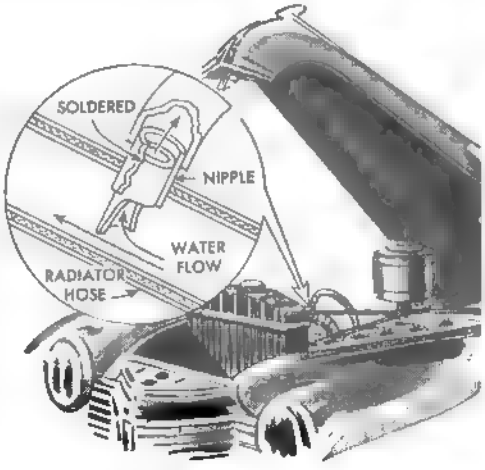
Glued Furniture Joints Dry Quickly Under Infrared Lamp



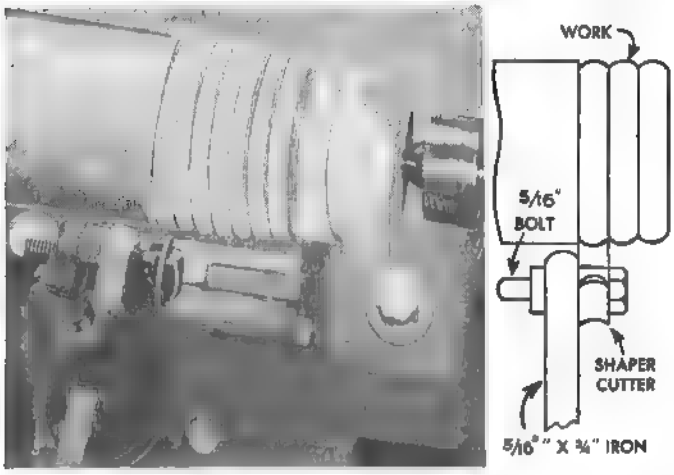
When time is a factor, the heat from an infrared heat lamp will hasten the drying of small glued joints, such as chair rungs or legs. This works best when using a resin-type glue, which sets quickly when heat is applied. Small furniture repair shops will find this hint helpful in doing "while-you-wait" and similar rush jobs.

Baffle Directs Flow of Water To Increase Heater Output

Troubled by poor water circulation through the hot-water heater of his car, which had no thermostat in the cooling system, one motorist found that a baffle installed in the heater-hose nipple at the point where it enters the radiator hose helped deflect the water into the heating system and increased heat output as much as 50 percent. The baffle is a short piece of copper tubing, cut to the shape shown, and forced tightly into the hose nipple. Let it extend 1 in. and solder it to the nipple.



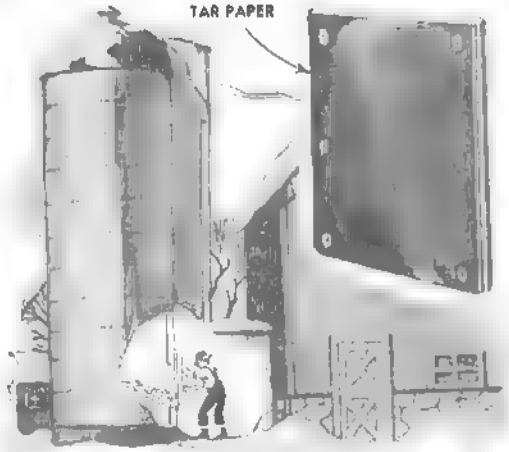
Shaper Cutter Mounted in Lathe Tool Post Permits Turning Uniform Beads and Coves



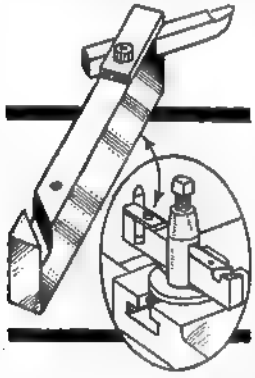
Turning small beads and coves and spacing them uniformly is easy to do if a shaper cutter is used. To do this, bolt a small cutter of the desired profile to a piece of 5/16 by 3/4-in. flat iron. The end of the flat iron should be rounded and the cutter mounted near enough to it to allow the rounded end to serve as a depth stop. Then fasten the unit in the tool post in the usual manner. To obtain the best results on wood, set the cutter on the work center line, but when using the cutter on plastics, set it at approximately a 10-deg. negative rake.

Silage Will Not Freeze to the Inside of Door Having Tar-Paper Cover

If you want to keep silage from freezing to the doors in cold weather, next time you fill the silo, try covering each door on the inside with tar paper. In most cases this will keep the silage from freezing and sticking to the door so that it has to be chopped away. Ordinary roofing nails are used to fasten the paper in place and it should be left there permanently.



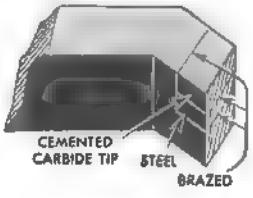
Dual Tool-Bit Holder



Saving the expense of a separate right and left-hand tool-bit holder, this holder incorporates both in one tool. It is made from cold-rolled bar stock and machined to fit the lathe tool post. Notches are cut and filed in each end at a 45-deg. angle to receive standard 3/16 or 1/4-in. tool bits. An interchangeable clamping pad locks the bit securely in either end. Positive clamping is assured by filing the notches to a depth slightly less than the thickness of the tool bit. A machine screw tightens the clamping pad.

¶Try lubricating an electric drill by dipping the bit into ■ can of oil. This will save time and dissipate heat effectively.

Repairing Carbide-Tipped Tools



When a large carbide tip on a high-speed bit has broken and the bit underneath the tip is damaged, one machinist repairs the expensive tool in the following manner. First, he anneals the end of the bit and cuts out the damaged portion. Then he cuts a piece of steel to replace the removed part of the bit and brazes this and a new carbide tip to the original bit.

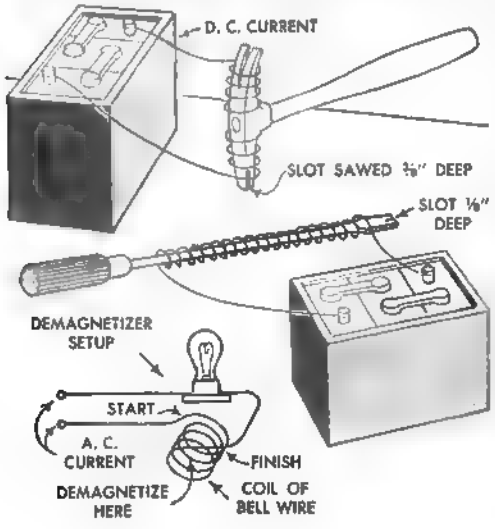
Harold Peterson, N. Troy, N. Y.

Sickle Section Bolted to Handle Forms Handy Bundle Cutter

A useful tool for cutting grain-bundle bands is made by bolting a section from a power sickle to a slotted wooden handle. The latter can be cut from a broomstick or tool handle. A leather thong or piece of rope looped through a hole drilled in the end of the handle will permit carrying the tool on the wrist.

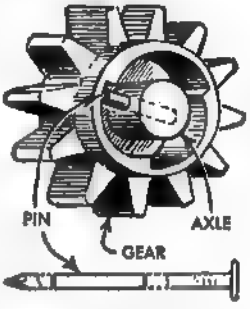
Tools Permanently Magnetized With Battery and Wire

If you have a screwdriver, tack hammer or other tool that you wish to magnetize, this may be done easily with a storage battery and a length of heavy-gauge, flexible wire. First, slot the face of the tool with a hacksaw to provide two poles, similar to those on a horseshoe magnet. Then, form the wire into a coil of about 10 turns and fasten each end to a storage-battery post. Insert the tool through the coil, allowing it to remain there approximately 10 min. Rub it lightly on a piece of iron or steel during this period. To make a demagnetizer, take a coil of bell wire and connect it in series with a lamp bulb on a.c. current. Pass the tool through this coil several times, testing it for magnetism each time until the tool is completely demagnetized.



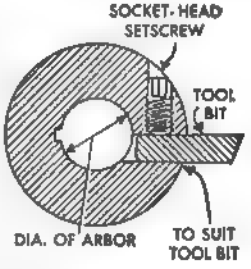
Phillip Wilson, Streator, Ill.

Repairing Lawn-Mower Gears



Some lawn-mower drives are fitted with round pawls, and when the pawls and ratchets become unduly worn, the drive will slip or engage and release intermittently. This may be corrected by inserting new pins made from pieces of nail. These should be about ⅛ in. longer than the old pins and the edges should be chamfered slightly instead of rounded, so the pins will not slip over the ratchet teeth. These pins will remain serviceable for about one season and they will not cause additional wear on the gears. You may have to file the pins lightly and check several times before you obtain the proper length.—C. Siegrist, Rexmont, Pa.

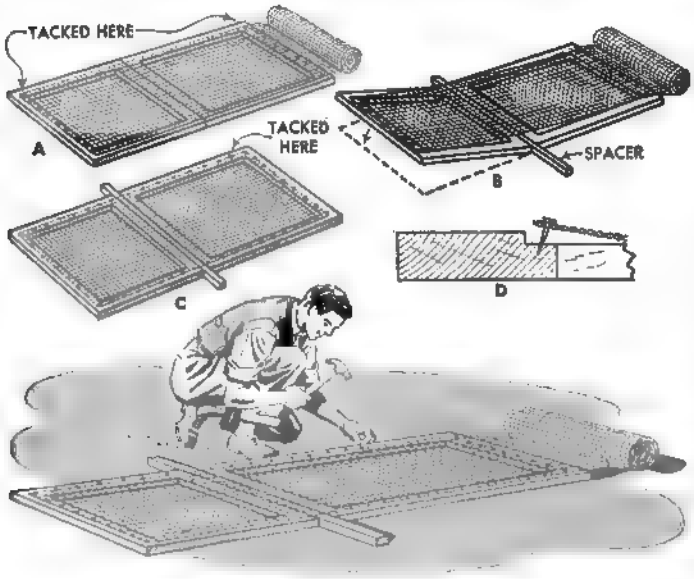
Collar Prevents Chattering Of Boring Bit



Excessive chattering of a milling-machine fly cutter is reduced considerably if the tool bit is supported and locked in a keyed collar instead of being mounted directly on the arbor itself, as is the common practice. A square hole is made in the edge of the collar to take the tool bit. The bit is locked in place with ■ socket-head setscrew which is fitted in a tapped hole drilled at right angles to the square hole. The square hole is located so that the face of the tool bit is on the center line of the collar and therefore does not change the outline of the cutting edge. The hole for the tool bit is made by filing a round hole square.

M. R. Therien, Barriefield, Ont., Can.

Screen Wire Stretched Firmly By Covering Two Frames at a Time



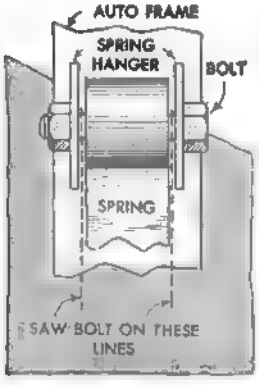
When renewing screen wire this spring, a taut, even screen can be had by covering two frames of the same width at one time. Start by laying the two frames end to end and tacking the screen wire to them as shown in A. Next, insert a wooden spacer between the frames, B, and force them flat to stretch the wire tightly. The wire is made taut crosswise by tacking one side of both frames, C, and applying tacks to the opposite side at an angle, D. Then tack the wire to the remaining sides of the frame and cut them apart.—A. W. France, Raritan, N. J.

Plaster-of-Paris Sanding Block Molded to Match Contour of Work

A quick, easy way to sand irregular-shaped molding is to use a sanding block of plaster of paris molded to the shape of the work. To form the block, cover an identically shaped piece of work or the work itself with a sheet of wax paper and carefully mold a thick block of plaster of paris on the wax paper to fit the contour. For small work, wood putty may be substituted for plaster of paris.

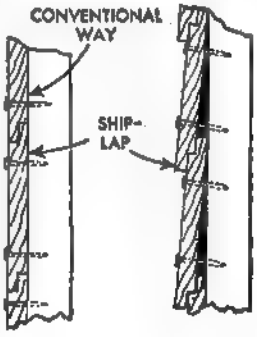
Removing Rusted Bolts From Car Springs

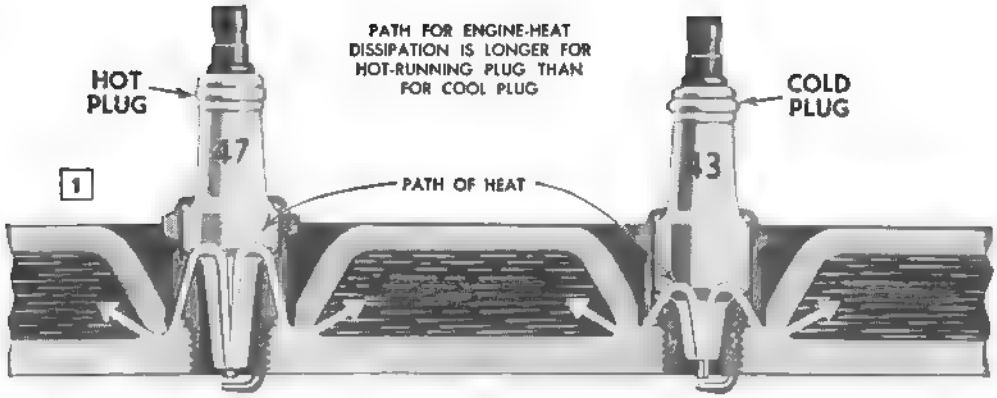
Recently when trying to remove the rear springs from my Chrysler, I found that the shackle bolt on the front spring hanger had rusted to the steel bushing. Penetrating oil would not free the bolt, nor would pounding with a heavy hammer. Not having a cutting torch at hand, I used a hacksaw to cut through the bolt at each side of the spring, and then knocked out the parts with a punch. As the bolt was not hardened, the hacksaw did the job.—D. W. Brentlinger, Richmond, Calif.



Shiplap Gives Bevel-Siding Effect

Shiplap will give the appearance of the more expensive bevel siding, if nailed to the studding in the manner shown. It is best to plane off the tongue from the bottom or starting board and also to use a furring strip under the base of this board to retain the bevel effect. Take care not to draw the lower nails too tightly or they may split the boards where they lap.—Herbert E. Fey, New Braunfels, Tex.





WATCH YOUR SPARK

REGULAR servicing procedure applies to the spark plugs, just as it does to all other parts of the car that require periodic attention. Plugs should not be removed, cleaned and adjusted by a haphazard schedule. This may often do more harm than good as frequent removal and reinstallation of plugs is ordinarily unnecessary and causes undue wear on the threads of both the plug and cylinder head. This is especially true when the car is new, unless, of course, faulty engine performance at some time during the first few thousand miles fouls the plugs. In older cars the plugs, and also the ignition system, require a careful check more often to keep these parts performing properly. Badly worn pistons, cylinders and rings accelerate wear on the plugs. On the average, plugs need a careful check every 3000 to 5000 miles, and should be replaced with new ones every 10,000 miles. They will run longer, of course, but with greatly reduced efficiency. At the regular checks of other parts of the car examine each plug to see that the exposed portion is clean and dry, and that the plug wire snaps over the terminal firmly and with a clean connection, Fig. 10. Other parts of the ignition system should be inspected regularly to assure delivery of the normal high-tension current to the plugs.

The basic parts of a plug are shown in the cross-sectional drawing, Fig. 2. Inspection of these parts will tell a lot about how the plug is performing and what to do about correcting any trouble that may develop. The six photos below picture some of the common causes of plug failure.

A plug must run hot at low engine temperatures, and cold at high engine temperatures. The running temperature of the plug must be sufficient to burn off ordinary carbon deposits but not so high as to cause detonation, pre-ignition, fusing or blistering of the insulator, or rapid erosion of the points. To obtain the right plug temperature, use a plug of the correct "heat range." This is determined from the type of engine and the operating conditions. When buying a set of plugs, remember there are three "heat range" types—hot, normal

Cracked, dirty insulators affect engine performance, cause compression leaks, shorts, fuel waste

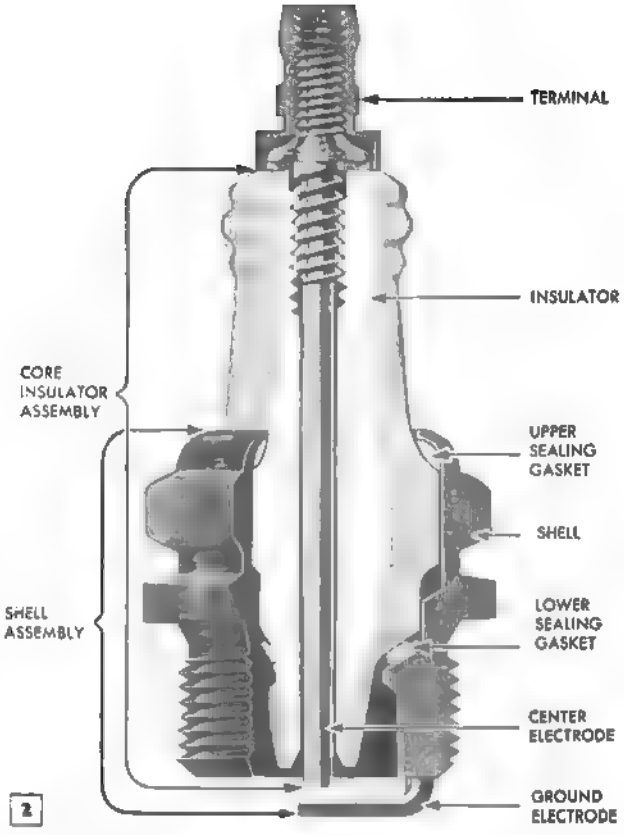
Plug has been running too cool. Shell, electrodes and insulator are fouled with hard carbon deposits

Insulator eroded by oxidation. Tends to short the plug, causing the engine to miss at high speeds

Clean plugs, properly chosen for heat range, give peak engine performance with very substantial savings in fuel and oil consumption and reduce costly repairs

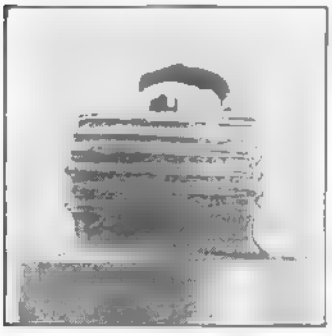
By Phil Ruskin

PLUGS



and cold. The hot plugs, Fig. 1, have a long insulator with a correspondingly longer path for the dissipation of heat to the engine block. The insulator on the cold plug is short, heat is dissipated rapidly, and it operates much cooler. A plug operating at the correct temperature will have a soft, powdery deposit on the nose of the insulator—either a grayish tan or rusty brown in color. Wear of the points will be normal and confined to the faces of the spark gap. If point wear is rapid while the color of the insulator is normal, the gap may be incorrectly set or the fault may be in the wrong type of coil. It's well to keep in mind, too, that in old cylinder heads there is the possibility that water passages near the plug may be partially or wholly blocked with hard deposits, causing a hot spot in the head that may affect the plug. Plugs operating too hot will show dark spots or blisters on the insulator nose. The points will be badly burned, in proportion to the length of time the hot condition has existed. Fused and glazed deposits on the insulator may "short" the current and cause misfiring.

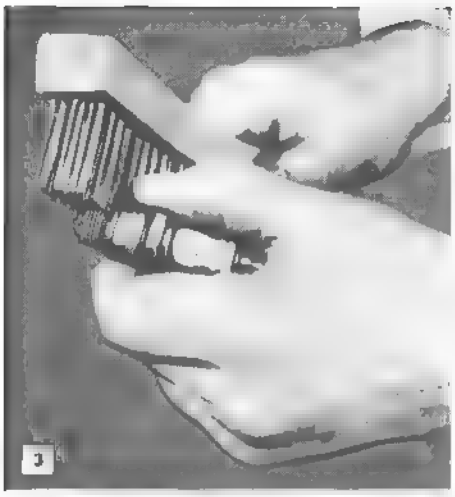
Often a plug will be of the correct heat type for a particular engine and still run hot. In this case, the plug may not be tightened sufficiently, permitting hot gases to



This happens when a plug runs too hot. Undue wear of the electrodes shows in comparatively short time

According to reliable tests, plugs in this condition may waste as much as one gallon of fuel in ten

Insulator broken at the lower end may be due to hot operating conditions or careless installation



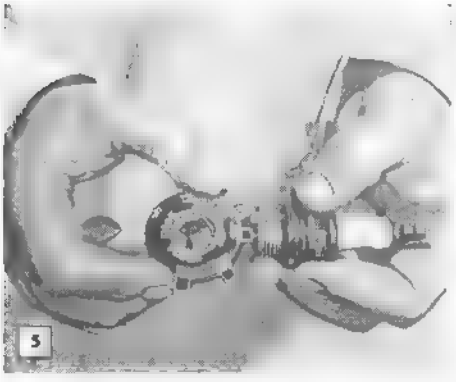
Clean the threads of the shell thoroughly. Carbon deposits here will retard dissipation of heat

Shallow-pitted electrode points can be restored by the careful use of fine-grit abrasive or a file

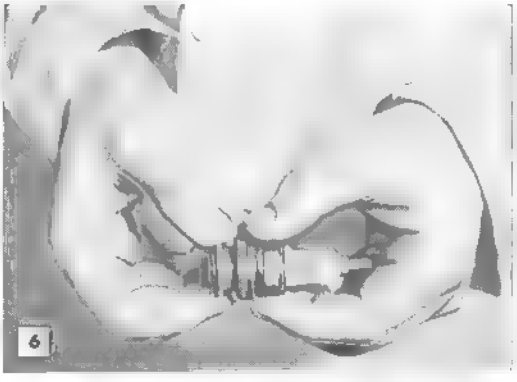
escape and heat the plug in passing out. There may be gas leakage between the insulator and the electrode, or between the insulator and the shell. This condition can be detected by soot streaks on the outside portion of the insulator. A lean fuel mixture, wrong ignition timing, poorly seating valves and other faulty engine conditions, can cause plug overheating. Plugs running too cold will be sooty, gummy and possibly oily. Oil pumping from the crankcase, too rich a fuel mixture and long idling periods will cause this condition. Fuel fouling is indicated by a dull, black, fluffy deposit; oil fouling, by a shiny, black, hard deposit. In judging plugs for heat range, be sure normal operating conditions have existed for a time before making the inspection. Otherwise, one may get a false interpretation of the average plug needs of the engine.

Although servicing a spark plug looks simple enough, there is danger of permanent damage to the plug unless certain precautions are carefully followed. Use a socket wrench of the correct size to remove the plug—never use an end wrench or other makeshift wrench that is likely to burr the plug nut or slip off and break the insulator. Blow dirt out of the plug well before removing the plug to prevent it from falling into the cylinder. Condition of the gasket is important. Inspect it carefully each time the plug is removed. It may be the key to plug trouble or poor engine performance. If the gasket is flattened or badly scored, it may be the cause of a baffling compression leak as well as a hot plug. On the other hand, if the gasket is still rounded, it is probable that the plug has never been correctly tightened. This condition may also be the cause of a hot plug or a compression leak. If there are indications of soot and burning on the gasket, it was not tight enough to seal. The gasket serves the dual purpose of sealing engine compression and acting as a bridge for the dissipation of heat.

After removing and inspecting the plug and gasket, clean the shell threads, insulator and



Use a round gauge to check the gap. Adjust to exact distance recommended by the manufacturer



Before replacing a plug, turn a new gasket over the threads by hand. Make sure gasket is properly seated

points carefully as in Figs. 3 and 4. Or if desired, take the plugs to a service station equipped with a spark-plug cleaning machine. If the insulator is badly fused, cracked or blistered, the plug should be replaced. Plugs with badly corroded and worn points also should be replaced. Adjust points to the correct spacing by bending the side electrode, never the center one. Use a round gauge, Fig. 5, to check the gap setting recommended by the car manufacturer.

When installing the plug, always use a new gasket and turn it over the shell threads as in Fig. 6. Before screwing the plug into the cylinder head clean the gasket seat with a cloth as in Fig. 8. Turn the plug in by hand, making sure the thread is not crossed and the gasket is not cocked at an angle. Snug it up by hand also, then tighten with a socket wrench only one half to three quarters of a turn, Fig. 7. Wipe the insulator as in Fig. 9 and be sure to connect the correct wire to each terminal.

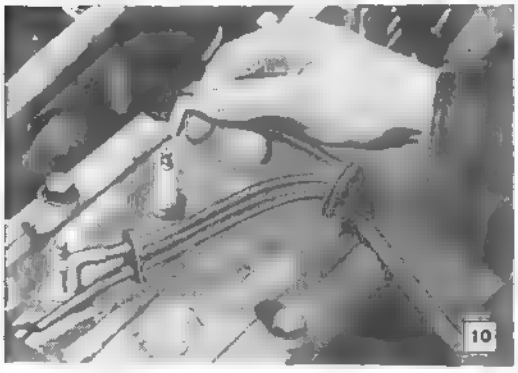
If plugs foul in a new engine, check for wrong lubricating oil in the gasoline for run-in purposes; carburetor adjustment out; improper choke adjustment; car driven too slowly during break-in period; distributor points incorrectly set; coil or condenser weak; plug gap set too close. If the engine misses at high speeds or under a heavy load, check these common causes: distributor points dirty, glazed or incorrectly set; weak coil or condenser; carburetion incorrect; valve-tappets out of adjustment; plug gap set too wide; overheated plugs, calling for cooler plug in the heat range, overheated plugs due to gasket leakage or other causes.

If the engine "rolls" when idling, check the carburetor adjustment; distributor points; coil; engine compression; valve-tappets; improper valve timing; sticking valves and the plug gap. When making any inspection with the plug removed, always check the gap.

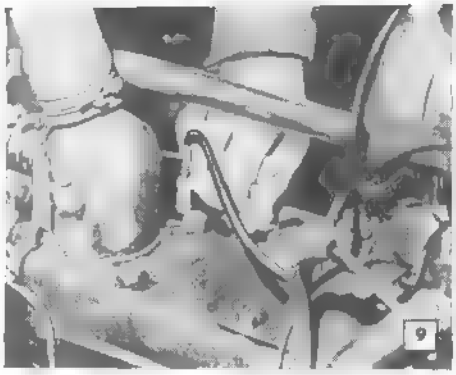
Certain photos and details by courtesy of A.C. Spark Plug Div., General Motors Corporation; Champion Spark Plug Co., and The Electric Auto-Lite Co.

When removing or tightening plugs, use a socket wrench. Other wrenches may burr the hex section

Wipe the gasket seat with a clean cloth before installing plug. Avoid pushing dirt into opening

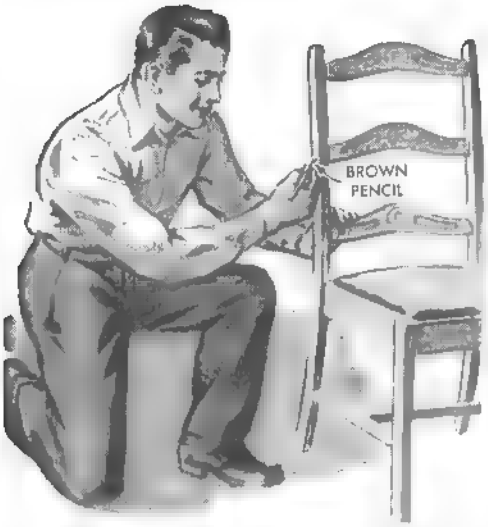


It's very important to attach the correct ignition wire to the terminal after cleaning and installing the plug



Clean the insulator after installing the plug to prevent shorts through caked dirt or hard grease

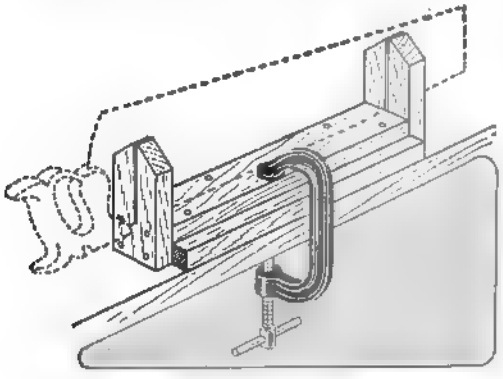
Furniture Scratches Touched Up With Brown Pencil



To cover scratches in furniture or interior trim that you do not wish to refinish, use a pencil with a brown crayon lead. This makes an inconspicuous repair and, if the pencil mark is covered with furniture wax or polish, the scratch will be difficult to detect. After filling the scratch, rub it with the tip of your finger to blend the color. Keep a fine point on the pencil lead for filling very small scratches.

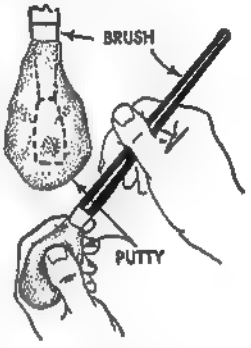
Saw Vise for Home Workshop

For the craftsman who has an occasional saw-filing job, this vise, or holder, is simple to make and economical in cost. The only materials required are a few odds and ends of scrap wood. Dimensions are omitted because they are determined by the size of handsaws that are to be sharpened. Construction details and method of assembly are indicated in the drawing. A C-clamp is used to fasten the holder to a workbench and then wedges are inserted in the slotted endpieces to clamp the blade firmly. Be sure to use hardwood for the endpieces to prevent splitting when wedging. When sharpening a saw, support it with the hand placed close to the point where you are filing to prevent the blade from whipping.



Victor Lamoy, Upper Jay, N. Y.

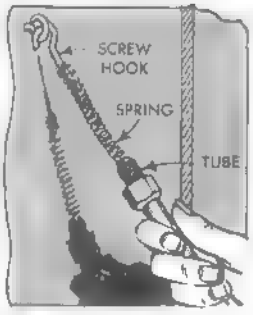
Paintbrush Kept in Readiness By Sealing in Ball of Putty



When a small paintbrush is laid aside to be used subsequently to apply the same color of paint, one painter does away with the necessity of having to clean the brush each time. He merely wipes off the excess paint and rolls the bristle end of the brush in a ball of soft putty. The putty keeps the bristles moist and ready for use by forming an airtight seal around them.

G. E. Hendrickson, Argyle, Wis.

Screw Hook Aids in Cleaning Gasoline-Stove Generator



The generators or generating tubes on some gasoline cooking ranges are "packed" with a small coil spring, which aids in vaporizing the gasoline fuel before it enters the stove burner. After varying periods of use, depending on the quality of fuel, the spring becomes clogged with carbon and must be cleaned or replaced. However, removing the spring is difficult without the proper tools. While trying to repair his own generator, one man found that he could pull out the spring by using a screw hook as indicated. The hook must be of a diameter just slightly larger than the inside diameter of the spring so that when it is screwed in, the threads will engage the coils of the spring.

Lester M. Diehl, Pittsfield, Mass.

If a stairway to a basement or attic is without handrails, stretch a strong rope at the sides to serve as temporary rails.

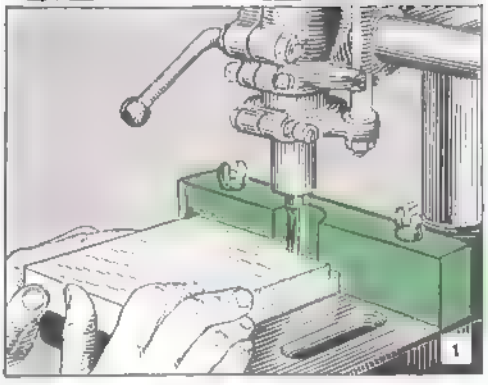
DRILL-PRESS ROUTING

Easy-to-make jigs that clamp to the drill-press table guide the work for accurate uniform routing

By E. Waltner

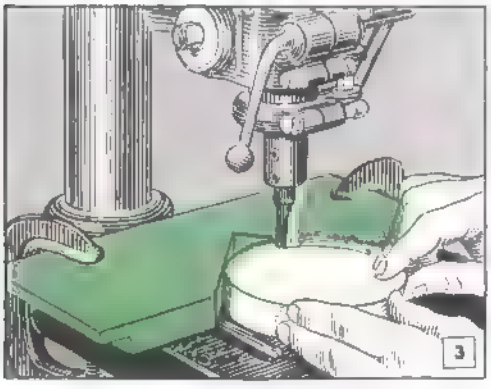
A FEW SIMPLE JIGS plus an assortment of router bits are all that is needed to convert a drill press into a router. A spindle speed of about 5000 r.p.m. is satisfactory for most routing. However, when using small-diameter router bits or when production-routing, 8000 to 10,000 r.p.m. is recommended. In most cases, the jig or guide fence, shown in color on the illustrations, should be clamped to the drill-press table back of the work. The work is fed from left to right, or against the cutting rotation of the router bit. If it is necessary to clamp the fence in front of the work, the work must be fed from right to left. To avoid heating the router bit and thus drawing the temper, the work is fed slowly and uniformly.

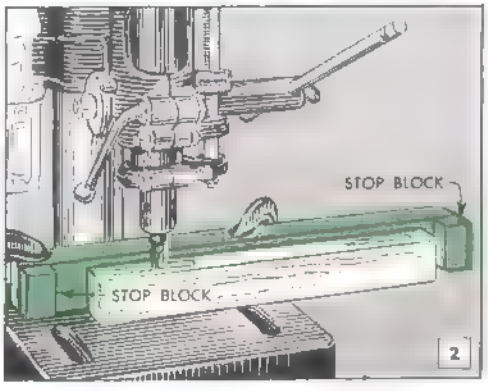
Rabbeting is done by guiding the work against a straight fence having a semicircular cutout for the router bit, as in Fig. 1. The size of the rabbet is controlled by locking the spindle sleeve at the desired depth of cut and adjusting the fence forward or away from the router bit as required. Fig.

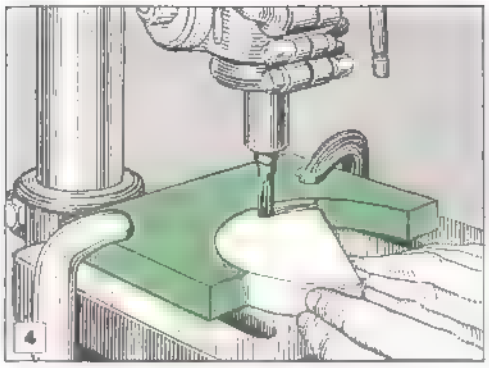


↕ Fence clamped to table guides work being routed. Routing mortise with aid of fence and stop blocks

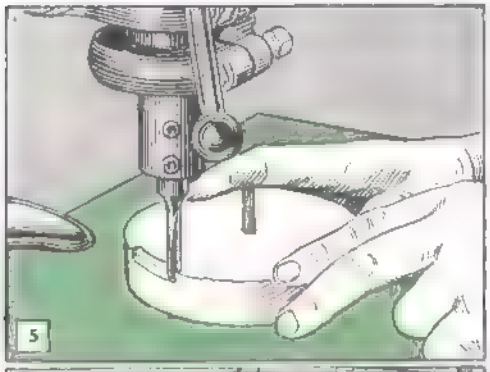
Varying distance of V-block jig from router permits accurate routing of wide range of circle sizes

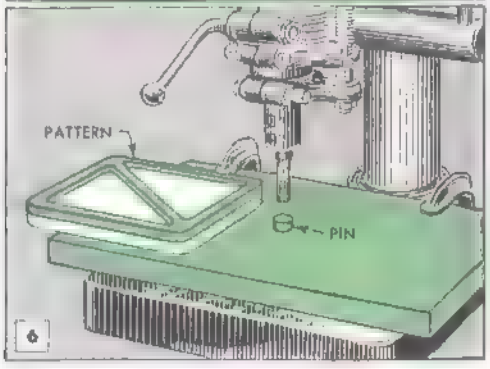




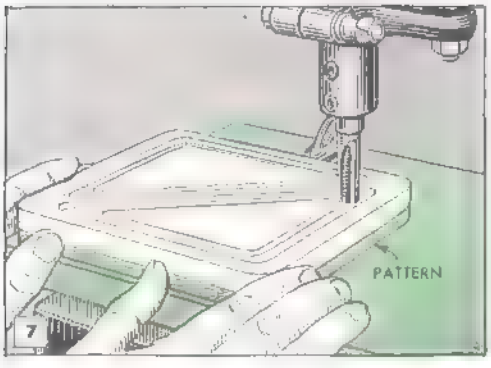


Routing semicircular piece using waste part as jig. Pin aligns work for routing rim of circular piece





Pin-and-pattern jig for routing duplicate parts. Pattern is placed over pin and guided around li



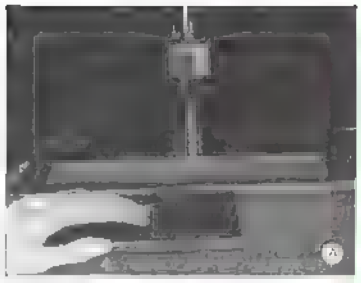
2 shows how to cut mortises. Note that stop blocks are fastened to the guide fence at each end to limit the length of the mortise. This method is particularly useful when making duplicate parts. Drill a hole at the start of the cut, using the router bit as a drill bit. Then with the bit in the hole, lock the spindle sleeve for depth and advance the work to the right-hand stop block. If the mortise is more than ½ in. deep, drill a series of overlapping holes along the length of the mortise and then rout out the remaining wood.

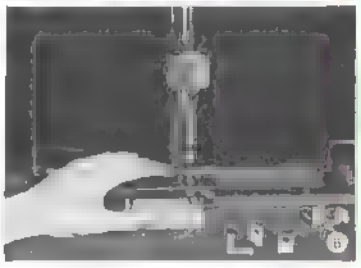
When routing circular work, use a V-block jig as in Fig. 3. The work is held against the two sides of the vee and slowly rotated. One jig of this type may be used for a wide range of circle sizes by simply clamping it to the table at the required distance from the router bit. When the work is only a portion of a circle, a jig cut to the same radius as the work is used as in Fig. 4. If the circle has been carefully bandsawed, the waste portion of the wood will serve as a jig. In addition to the V-block method, routing around the rim of a circular piece of work is done with a pivot pin as in Fig. 5. The pin is set in a board clamped to the drill-press table. With this method, the work must have a hole through its center. However, if this is objectionable, a shallow hole can be bored in the underside of the work, and the disk pivoted on a very short pin.

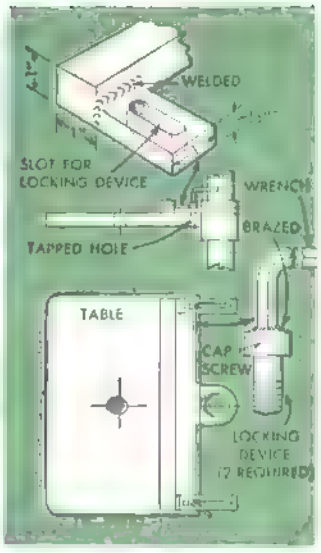
When routing special shapes covering an area too large to be removed with a single pass of the router bit, a pin-and-pattern jig, Fig. 6, is used. A full-size pattern is cut from ¼-in. plywood and tacked to the underside of the work. The pin, which can be either metal or wood, must be the same diameter as the router bit. It is set in a baseboard so its projection above the surface of the board is slightly less than the thickness of the pattern. Then the base is clamped to the table with the pin directly below the router bit. If the pin is not the same diameter as the router bit or is not aligned exactly with the bit, the work will not be an identical copy of the pattern. In use, the work and pattern are placed over the pin, as in Fig. 7. The bit is locked for depth by clamping the quill, and the outline of the pattern is routed in the work by guiding the cutout edges of the pattern against the pin. The remaining stock is removed by guiding the work freehand against the router bit until the entire space has been cleaned out. In some cases, it will be found helpful in keeping the pattern against the pin if the design is sketched on top of the work to serve as a guide.

Electric push buttons can be seen in the dark if coated with luminous paint.

Adjustable Fence For Drill Press



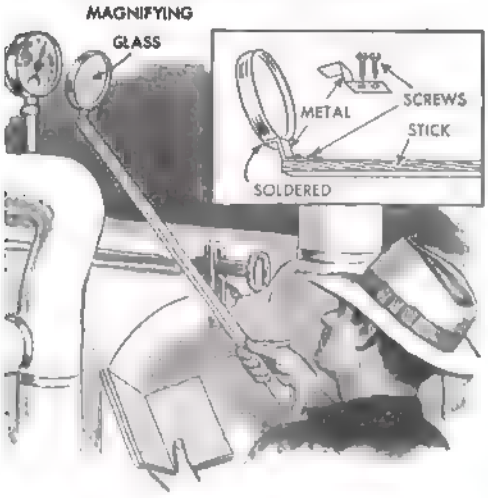




This drill-press fence can be used either to position flat pieces for drilling, detail A, or as a rigid support to which work can be clamped as in detail B. When not in use, the holder can be removed from the table or slid back out of the way. Assembly is shown in the right-hand detail. A slotted arm is welded to each end of the fence, which extends almost the width of the table. Holes are drilled and tapped in the drill-press table for two locking or adjusting screws. The latter consist of socket-headed cap screws with socket-type wrenches brazed in the heads of the screws. Besides being useful for drilling jobs, such a fence will be found handy for routing and shaping.

Edmund L. Johnson, Pittsburgh, Pa.

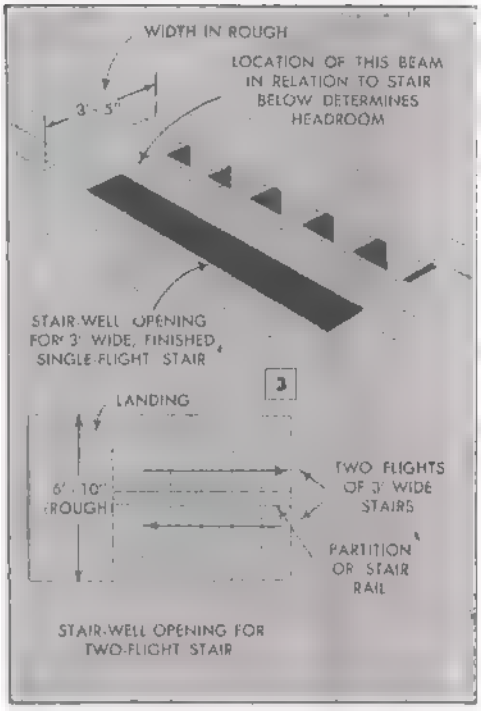
Pressure Gauge on Heating Boiler Easy to Read With Magnifier



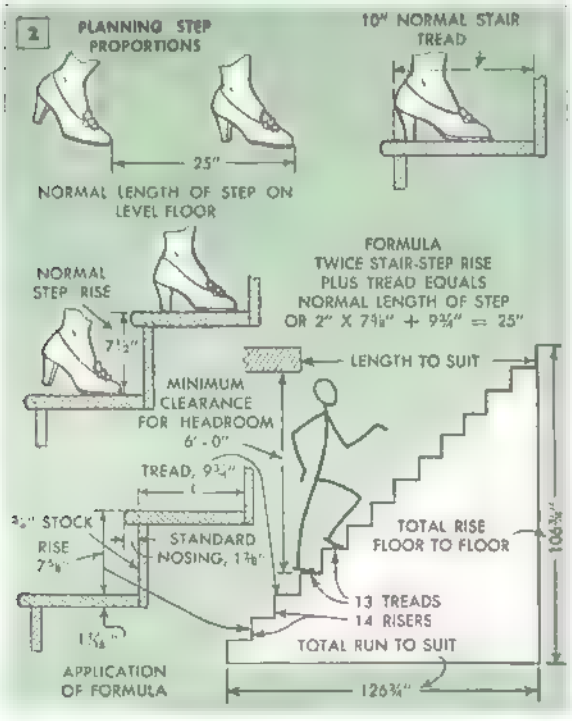
Usually the pressure gauge and other indicating instruments on a heating or power boiler are located on top of the unit, often in a dimly lighted spot, where they are difficult to read. To overcome this disadvantage, use a reading glass attached to a long handle so the glass can be held in front of the gauge. The rim of the glass is soldered to an offset metal clip, which in turn is screwed to the handle.

Bulletin Posted At a Filling Station Gives Motorists Weather Forecast

Salesmen, tourists and others driving through unfamiliar territory will appreciate the weather-bulletin service offered by one filling-station operator. The information, which includes road conditions as well as the weather, is posted on a blackboard suspended over the driveways near the gas pumps. The board slides on a wire between the station and a post, being high enough to clear the cars that pass under it. The sign is changed by sliding it over to a building or post so it will be accessible. Information about the weather can be obtained from the local weather bureau or over the radio.



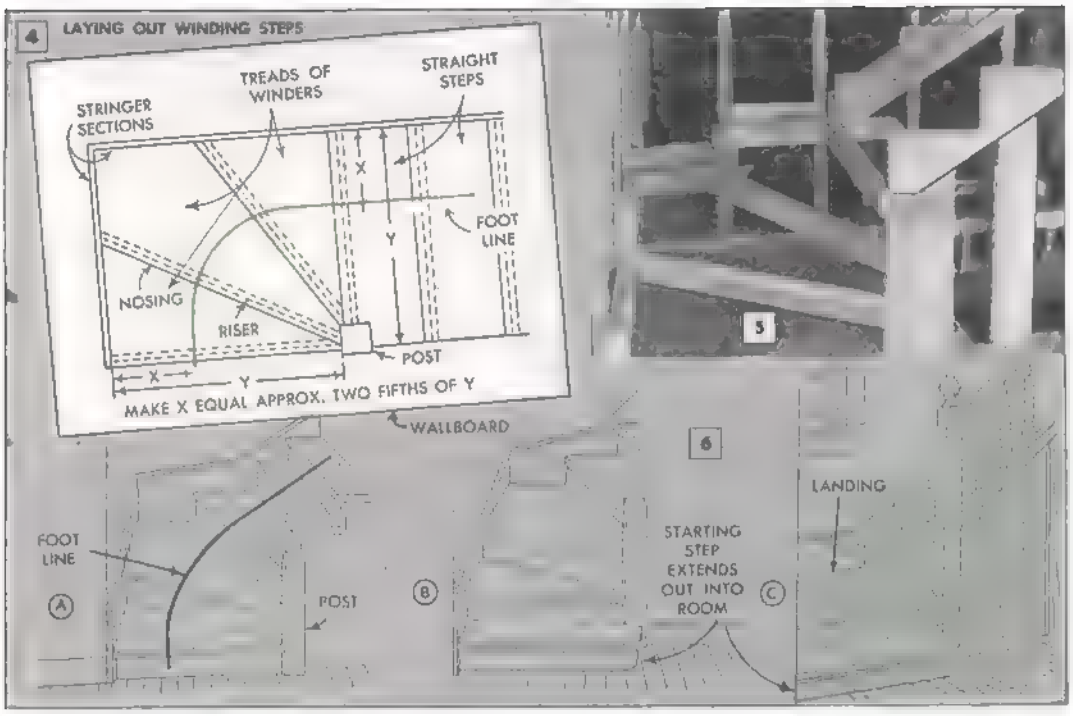
Above, stair rails of the type shown consist of a number of precut parts made from selected hardwoods. Below, layout of stair is based on normal length of step on a level floor



STEPS IN

INSTALLATION of a safe, attractive stair in either old or new homes is one of the most important details in the interior construction. Stairs that pitch too steeply, or those with abnormal treads and risers and insufficient headroom are a constant accident hazard. For safety, the stair must include all of the basic construction features detailed in Figs. 2 and 3. In the construction or remodeling of small and average-size homes in which stair space usually is limited, the two or three-directional, open-string stair with landings or winder treads often is best as it generally can be placed at the end of a room. In remodeling older homes it sometimes is necessary to use a single-directional closed-string stair, especially in large rooms.

In determining the step proportions for an average stair, use measurements of the typical step shown in Fig. 2. These dimensions should not be varied more than ½ in. either way, except in some special cases, such as on long flights made possible by ample space in large homes and buildings. On these stairs, a rise as low as 6 in.



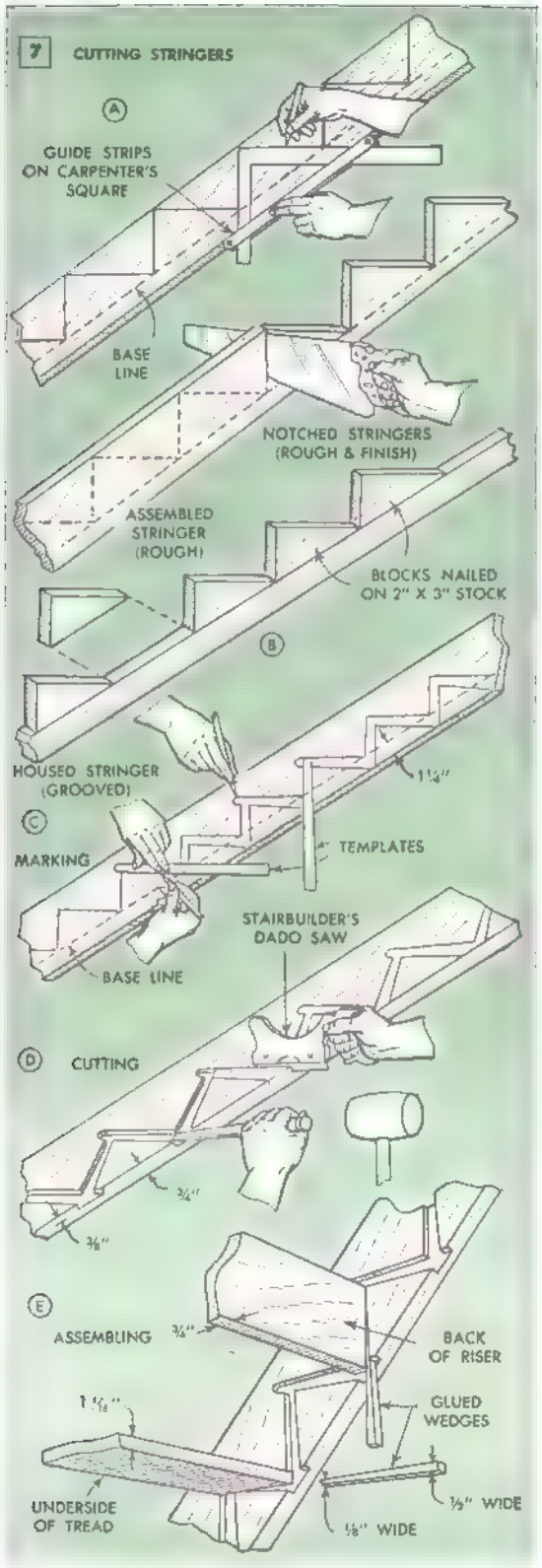
STAIR BUILDING

By John Modroch

and a tread as wide as 11½ in. may be used. Actual measurements will depend to some extent on how many steps of this proportion can be fitted into the stair space. To determine the number of risers for a given stair, first divide the total rise by the step rise, or a figure close to it that will give an even result. Then to get tread measurement divide the total run by the number of treads, which is always one less than the number of risers.

The stair opening, or well, should be cut wide enough and long enough to provide adequate headroom, Fig. 3. Remember also that dimensions of the opening must allow for the finish stringer, upper-floor nosing, and space for a rail. For example, the total finish allowance for the ordinary 36-in. single-flight open-string stair ordinarily would come to 5 in. These figures are based on ¾-in.-thick plaster wall and a standard 2⅜-in.-wide rail, plus 1 in. minimum finger room between the rail and wall. Always check walls of the stair well with a level and straightedge to determine beforehand the allowances for out-of-plumb walls, corners and other irregularities.

In planning the installation of a stair in a new location, which often is done in making alterations in old houses, obstacles that interfere with the placement of the stair well may be encountered. These may be supporting main beams or joists, chimneys or other installations that cannot be moved. If the obstacle is at one end of the proposed opening, the loss in length sometimes can be compensated for by shifting the location of the stair in the opposite direction. If this cannot be done, then winding steps or landings, Figs. 4, 5 and 6, sometimes can be installed. However, there is a definite minimum total run as well as ■ minimum headroom. Built to any dimension under these limits, the stair is not only difficult to ascend or descend but actually may be dangerous in some locations. Fig. 6, A, B and C, detail the commonly used methods of building approaches to both open and closed stair flights. In detail A, three winder treads are used. Winders are tapered steps which pivot at the newel post. Here the nosing of the winder starting step is flush with the stair wall. Better construction is shown in detail B where the starting step is straight and extends its width into the room. Somewhat simpler construction of the open-string stair employing a landing is indicated in detail C. In laying out winders, the plan should be drawn full size as in Fig. 4. The tread width of winders is gauged by intersecting the foot line, which represents the normal path of travel on winding steps, with a compass set to the tread width of the straight steps.



Only thoroughly seasoned lumber should be used in building a stair. Treads and risers in standard lengths and widths may be purchased. Treads preferably should be oak, dressed to 1⅛-in. thickness. Risers usually are cut from pine, ¾ in. thick. Starting steps, built with curved ends to match standard rails and newel posts, nosing returns and cove moldings, also are stock items. Clear ¾-in. pine boards commonly are used for making finish stringers. Rough stringers are cut from 2-in. stock.

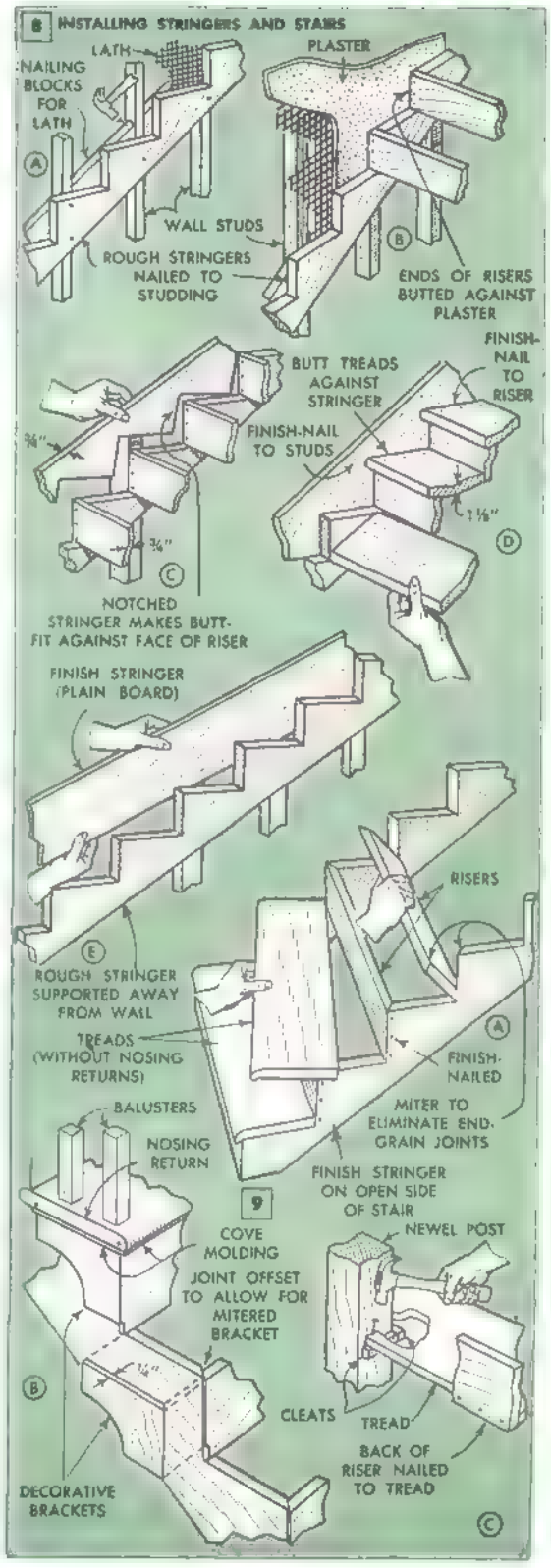
In building a stair, make the stringers first. They may be the open or notched type, details A and B, Fig. 7, or the housed type, detail C, depending on the method of stair installation. On either type, begin by laying out the rise and run of each step as in detail A. On a notched stringer make the saw cuts shown. On a housed stringer, locate and pencil the outlines of the grooves with the aid of two templates, one for the tread grooves and one for the riser grooves, as in detail C. Both templates must include an allowance for wedges, Fig. 7, E. When the layout is completed cut the grooves as in detail D. Be careful when chiseling out the waste to bring the grooves to a uniform depth. At this stage, cut risers and treads to width, but not to length unless the stair is to be assembled beforehand and installed as a unit.

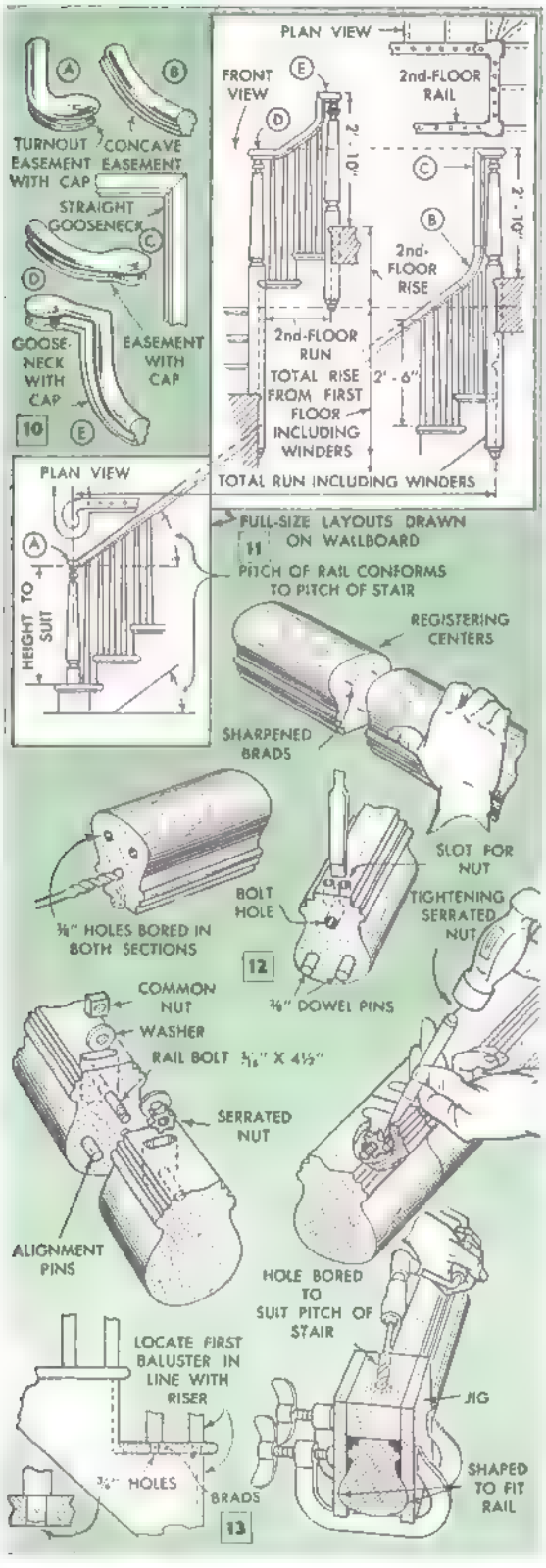
To avoid damage resulting from exposure to moisture in a new-house installation, the stair should not be installed until after the rooms have been plastered and have had time to dry out. However, where the rough-stringer method of construction is used, the stringers may be put in beforehand and temporary tread boards nailed on so that the stair can be put into immediate use. Finish the stair after the plastering is completed and thoroughly dried.

To install a closed-string stair in a plastered stair well, fasten the stringers to the walls by nailing through the plaster into the studding. Next, cut the treads and risers to length and wedge them in the grooves as at E in Fig. 7. Set the wedges in glue and be especially careful to drive them to a uniform tension. Where it is practical to support a notched wall stringer away from the wall, E in Fig. 8, a plain board can be used as the finish stringer, thus eliminating the need for notching or grooving. Slip the board down into the space between the

notched stringer and the wall and fasten with finishing nails driven through the plaster into the studding. Then install the risers and treads by butting them against the finish stringer instead of the plaster. Other methods of installing notched stringers are shown in Fig. 8, details A, B, C and D. A method of miter-joining the risers to notched stringers is shown at A, Fig. 9. The use of decorative brackets, detail B in Fig. 9, simplifies the miter-joining of risers and finish stringers on the open side of the stair, making it somewhat easier to produce neatly finished edges, and affording a simple means of correcting open joints caused by errors or inequalities of lumber. Anchor newel posts to the stair structure as shown in Fig. 9, detail C. If the installation permits working under the stair, the groove-and-wedge method as used with housed stringers may be employed for anchoring steps to posts, instead of the cleat-and-nail method shown at C. Wedges produce a tighter job. When installing a stair on subflooring, which is common practice, be sure to allow for the thickness of finish flooring by making corresponding increases in the width of the bottom riser and the length of the stringers and newel post.

An attractive stair rail not only is of decorative value, but it's an essential part of every stair as it reduces the accident hazard to the minimum. The rail must be rigidly mounted on newel posts that have been firmly anchored in the stair structure, and it should be capable of withstanding more than normal strain. To aid stairbuilders in doing good rail jobs at reasonable cost and with a minimum of hand work, ready-made rails are preferable for use on stairs of common measurements. These come in sections that are assembled on the job. Matching newel posts and balusters should be obtained with the rail. If the stair follows a normal layout with average run-and-rise measurements, it is easy to fit these standard parts. To determine the dimensions of parts needed, draw full-size plan and elevation layouts. A typical layout of the balustrade is shown in Fig. 11, the parts lettered A to E inclusive, Fig. 10, being shown in position in the plan view, Fig. 11. A common procedure is to assemble the rail in flight units, beginning at the lower, or starting, newel. First bolt the easement section of the rail to the starting newel cap. Join the gooseneck section of the





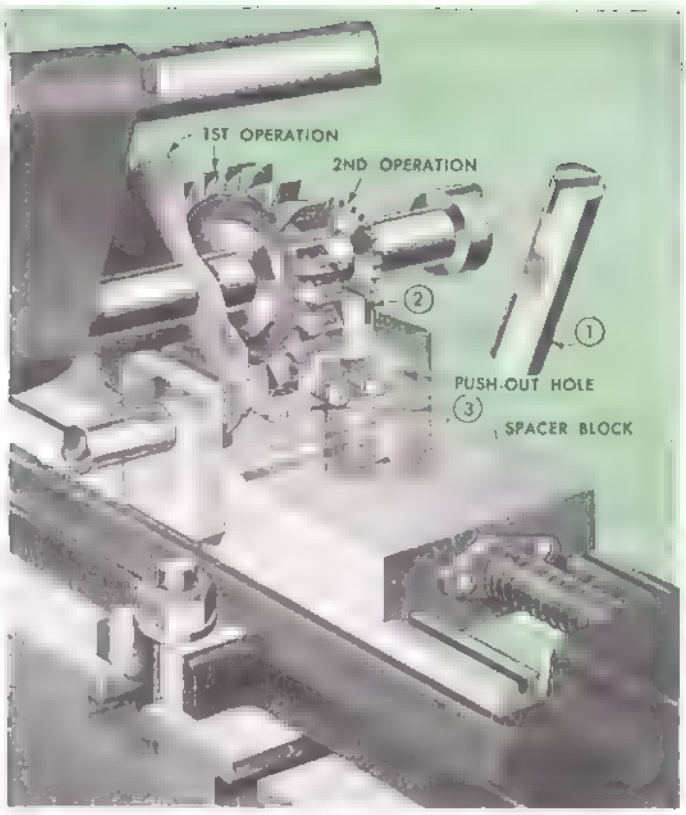
rail to the landing-newel cap. Then bolt the cap-and-easement units temporarily to the straight rail section, hold the assembly on the newel posts as in Fig. 1, and check the rail for length. Straight sections are joined with dowels and special stair-rail bolts as in the five steps shown in Fig. 12. Finally, complete the flight assembly by bolting on the cap-and-gooseneck unit. Assemble any succeeding flight units in the same way. In those styles where easements and goosenecks are not employed or in cases where factory-joined units are used, some of these special operations are unnecessary, of course. After the parts have been fitted and bolted together, fill openings and screw holes either with wooden plugs glued in, or with wood putty.

Balusters are fastened to rails in either of two ways, depending on the style employed. Square balusters, made to fit grooved rails, are held in position by means of spacers, or fillet strips, which are inserted between the balusters. Turned balusters are designed to fit into holes bored in the rails as shown in Fig. 11. Balusters of three different lengths are required for each step except the step directly under an easement, which takes a fourth size of extra length. To locate baluster holes on the rail, set it in place on the posts. Then raise plumb lines from the baluster holes in the step treads up to the rail, using a carpenter's level. Boring the holes at the required angle can be done accurately on the straight sections of the rail with the aid of the simple boring jig shown in the right-hand detail in Fig. 13. Holes in the curved sections of the rail must be bored freehand. In spacing balusters, locate the first one on each step in line with the riser as shown in the left-hand detail in Fig. 13.

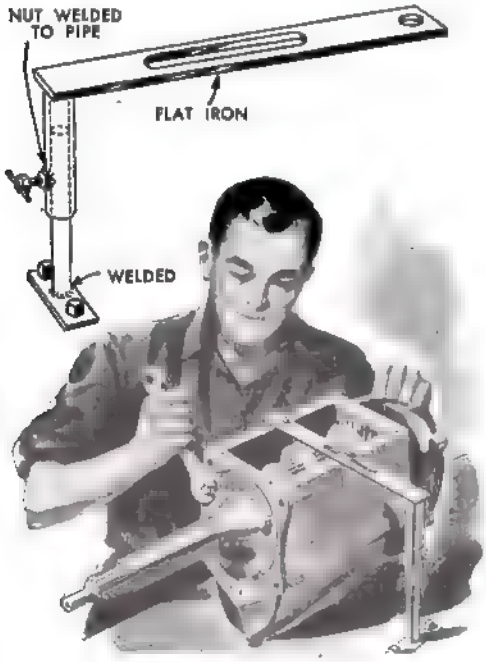
Before preparing a newly built stair for painting or varnishing, allow time for the wood to become adjusted to the atmospheric conditions in the house. Otherwise, slight shrinkage may loosen the filling in the joints and spoil the paint job. For this reason, it is best to do all other decorating work in the house first, leaving the stair to the last. Meanwhile, protect the treads from dirt and scuff marks by covering them with heavy paper held in place with cellulose tape. In painting the stair well do not get paint on the stair parts as it will be difficult to remove.

Setup Finishes Work In a Single Cut

This setup can be adapted to a considerable range of work that is milled from round stock. After the initial pass, one cut produces a finished part from that point on. The detail makes clear how this is done. The fixture is a milled rectangular block of steel slotted for the parting cut, drilled lengthwise, and also at right angles and then fitted with three setscrews, two on the long hole and one on the short hole. The initial operation as shown mills a flat and cuts off to length. The semifinished part is then pushed out through the push-out hole, dropped into the vertical hole and the setscrew is tightened on the flat. In this position, the part acts as a stop for the succeeding piece, Fig. 3. At the next pass the first piece is slotted, Fig. 2, the piece following is cut to length and the flat is milled. As the sequence is repeated each pass produces the finished part as in Fig. 1.



Care must be taken to see that the fixture is locked firmly in place, otherwise variations will show up in the finished work.

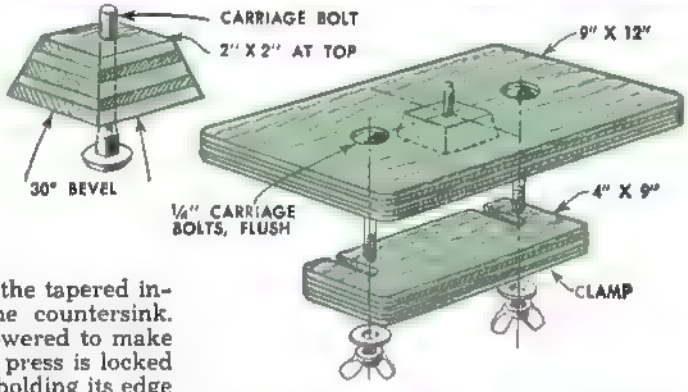


Adjustable Jig Holds Transmission Upright On Workbench

Dismantling an auto or truck transmission or a similar part on a mechanic's bench is a job that ordinarily requires the services of two men. But if this adjustable jig is used, one man can assemble or disassemble a unit and have both hands free for work. The jig consists of a rod with a mounting flange welded to one end and a slotted arm welded to a pipe sleeve, which telescopes over the rod. The sleeve is set at any desired height by means of an adjusting screw and nut, the latter being welded in place. Before welding, drill a larger hole in the pipe for the screw to pass through. The crosspiece has a bolt hole and a slot for fastening it to the top of the transmission. The slot makes it possible to handle transmission housings of several different widths.

¶Although it is recommended that cast iron be reamed dry, a little oil applied to the lands of the reamer will prevent the squealing noise made by a large reamer.

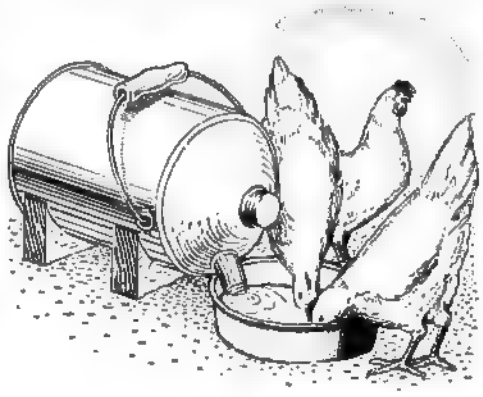
Jig for Scroll Chamfering and Pattern Routing



By using this jig as a guide, it's easy to chamfer the edges of a scroll-sawed cutout on a drill press with a rose-head countersink. The jig is made as shown and clamped to the drill-press table. The countersink, with the squared end cut off, is chucked in the drill press and the guide pin in the tapered insert is centered under the countersink. After the countersink is lowered to make the desired bevel, the drill press is locked and the work is guided by holding its edge against the pin. Standard ⅜-in. shaper cutters can be used instead of the countersink by mounting on a shaft and offsetting the guide pin to suit the depth of cut. The jig can be adapted for pattern routing by fashioning several wooden inserts and equipping each with a pin of a different size to correspond with the diameters of the routers that will be used. A template is prepared by sawing or routing a master pattern in a block of wood, and then tacking the pattern to the underside of the work. The pin is centered exactly under the router, and the work is guided by placing the master pattern over the pin. In this way, any number of identical pieces can be routed without further adjustment of the jig.

Poultry Watering Fountain is Improvised From Five-Gallon Oilcan

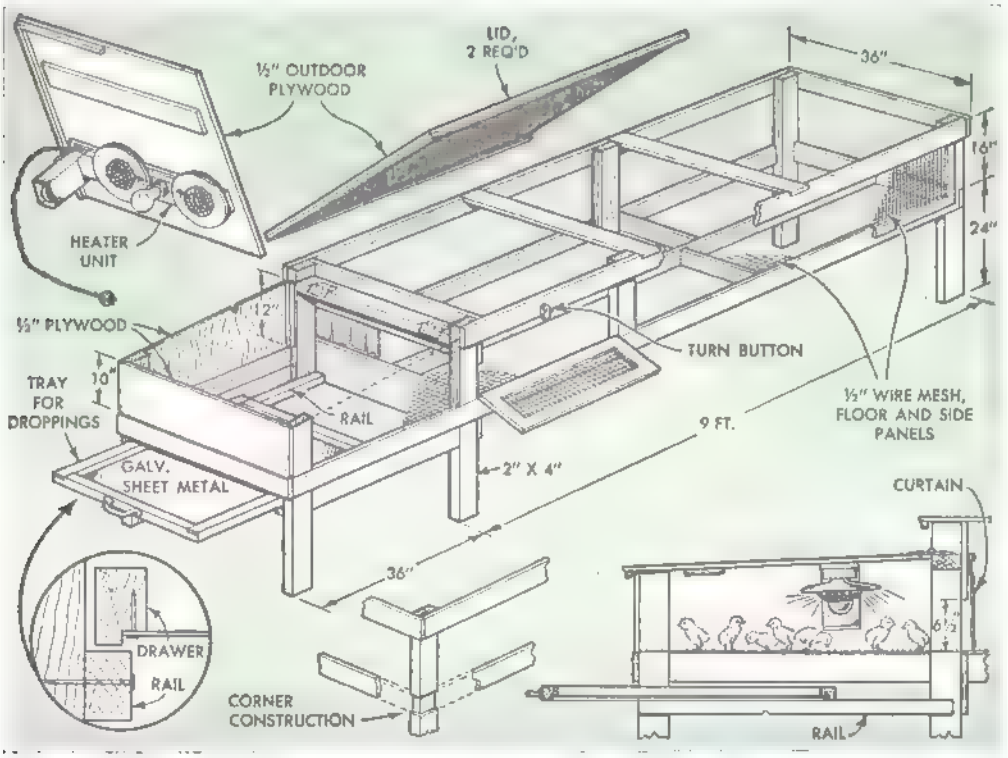
When small flocks of chickens or turkeys are moved to a temporary range where there are no facilities for supplying water, an automatic watering fountain can be quickly improvised from a 5-gal. fuel-oil can. The can is laid on its side and the spout is inserted to the fullest possible depth in a drinking pan. Water from the can will flow into the drinking pan and maintain a constant level, providing the filler cap of the oilcan is screwed tight to prevent the seepage of air into the can. Depending on the length of the spout the can may be held off the ground with blocks or propped so it will not roll.



100-CHICK BROODER AND RUNWAY

This wire-floored brooder is designed to accommodate 100 chicks from hatching time to the age where they can be released on open range. Wire floors of both the brooder and runway are 24 in. from the ground, a special feature of the design which makes it convenient to replenish the food and water supply and, at the same time, protects the chicks from rats and other vermin. A thermostatically controlled heating unit is installed in the hinged plywood cover, or roof, of the brooder. A hinged door shown on one side of the runway gives access to the interior, and a two-section plywood lid covers the runway to shield the chicks from the sun.

Wire floors in brooder protect chicks from vermin and disease. Heater maintains constant temperature

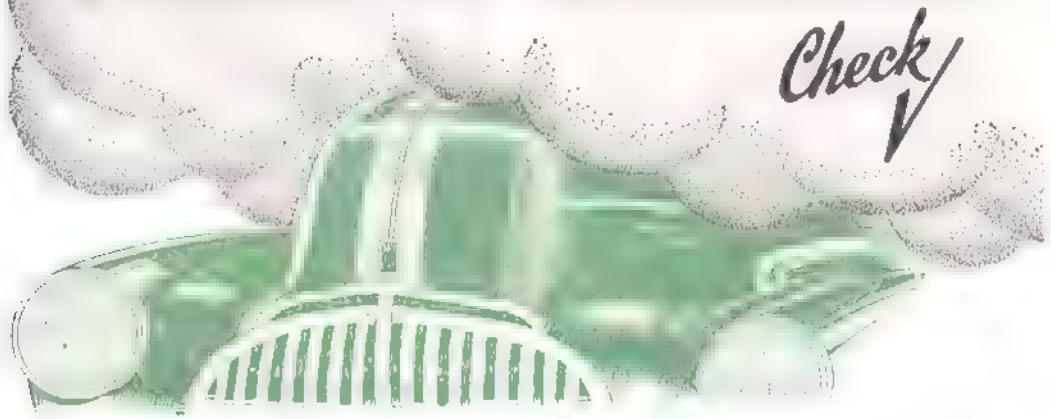


Come Clean!

GET RID OF WINTER'S RUST AND SCALE

- CHEMICAL FLUSH THE RADIATOR
- REVERSE FLUSH RADIATOR CORE
- REVERSE FLUSH ENGINE JACKET
- CHECK THERMOSTAT OPERATION
- EXAMINE WATER HOSE FOR DEFECTS
- INSPECT THE FAN BELT FOR PLAY
- BLOW OUT THE RADIATOR CORE
- LOOK FOR WATER-PUMP LEAKAGE

Check



By Wayne C. Leckey

SPRING means cooling system time—time to "clean house" on rust and scale and to take this eight-point precaution against **overheating**—the costly penalty of engine neglect. It's corrosion—rust, lime and grease left by hard winter driving—that retards heat dissipation and becomes the unsuspected cause of scored pistons, bearings and cylinder walls, burned valves and warped and cracked engine blocks. So play safe and guard the motor against these costly repairs by cleaning the cooling system regularly.

Chemical flushing: Draining the radiator of antifreeze and then simply flushing with water is not enough. A good cleaner is needed first to loosen the rust and scale. Such deposits act as an insulator and, if allowed to build up, may in time clog the fine water passages of the radiator. There are a number of efficient cleaning compounds on the market. Alkali-type cleaners, such as washing soda, are not entirely effective. They cut grease and sludge but have no solvent action on hard rust. Be cautious and select one that does not contain strong acids or caustics which might be harmful to the radiator core, and be especially careful if your motor is fitted with aluminum cylinder heads. Some chemicals used in cleaning preparations to loosen scale will also attack aluminum and damage the heads severely in a short time. After the cooling system has been drained, close both drain cocks and add the cleaner as in Fig. 1. Then refill and clean according to the directions.

Reverse-flushing core: The loosened particles are removed from the radiator most effectively by reverse flushing, that is, flushing in the direction opposite to that of the normal flow of water through the cooling system. This is done by first replacing the radiator cap, opening both drain cocks and disconnecting the lower and upper hoses. As shown in Fig. 5, the flushing is done from below and a drain hose is attached to the top. A satisfactory job of flushing can be done with a garden hose as shown in Fig. 2, although a more thorough cleaning is assured with a flushing gun which combines air pressure with water to

Don't be a Mr. Put-it-off. Make this eight-point inspection now and be ready for hot months ahead with a "cool" cooling system

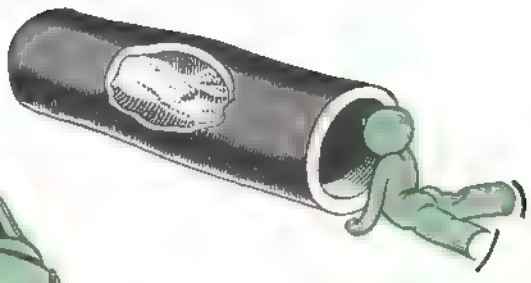
increase the scouring action and send the water through the system in forceful spurts. If such a gun is not available, a garageman will do the flushing job for you. However, be sure that you remove the thermostat beforehand, as cold water will cause it to close and build up harmful pressure. Flush until the water runs clear.

Reverse-flushing jacket: The same thing is done now to the water jacket, Fig. 3, which flushes the particles out through the water pump in the manner shown in Fig. 5. Attach a drain hose to the water-pump inlet, insert the gun at the top and flush as before. Some cars require removal of the water pump before pressure flushing to avoid unseating the pump sealing washer and forcing water into the pump bearings. If the car has a water heater, it should be flushed out too, as rust particles will form in the heater core as they do in the radiator.

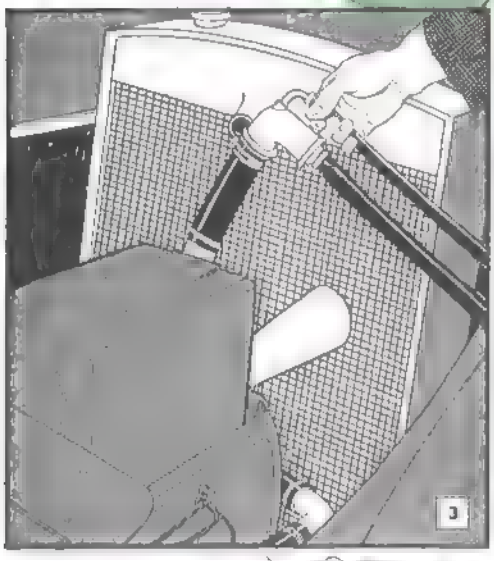
Thermostat test: After flushing, make sure that the thermostat is functioning properly. Normally, this can be checked by the gauge, but an accurate test can be performed by suspending the thermostat in water heated somewhat above the rated temperature, which is usually

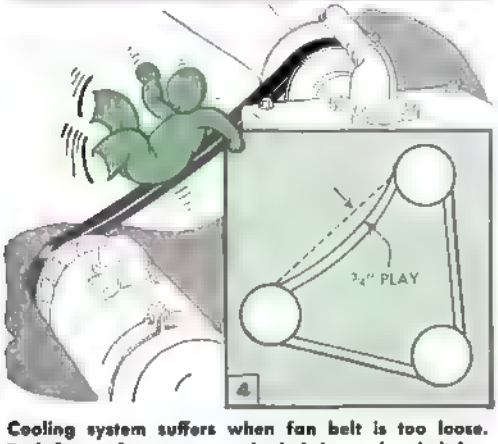
Here's how rust, boiled out of water jacket, can build up to obstruct the radiator tubes

Test thermostat's working order. Gummy one that fails to open causes overheating



Radiator hose wears out too. Gradual deterioration loosens lining which may retard the flow of water, and particles of rotted rubber can be carried into radiator water passages





Cooling system suffers when fan belt is too loose. Both fan and water pump do their best when belt has ¾-in. play. Tight belt wears bearings prematurely

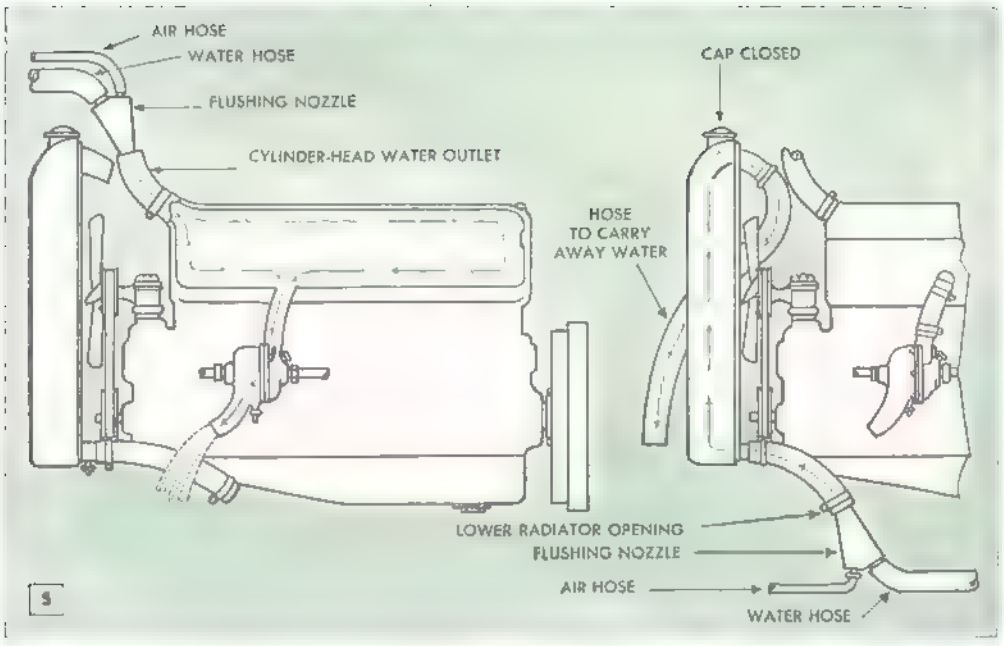
marked on the thermostat. If you find that the valve fails to open within 10 or 15 degrees of the rated temperature, it should be cleaned, if gummy, or replaced, as a faulty thermostat will cause the engine to overheat.

Water-hose checkup: Don't replace the radiator hoses without first examining them carefully, especially on the inside, for deterioration. If there are signs of rotting, replace them, as loose particles of rubber may clog the water passages of the radiator. Also, too soft tubing may collapse from suction. When replacing either the old or new hose, use gasket shellac on the metal parts over which the hose slips to assure an airtight seal at this point, and draw up the hose clamps tightly. Now, refill the radiator, preferably with soft or rain water. Lime in hard water causes scale to form in water passages much the same as it does in a teakettle. Bring the water level to about ½ in. above the top of the tubes in the radiator. Avoid "filling" either summer or winter. Be sure to add a can of rust inhibitor, too. With a good active inhibitor in the water, rust can be kept to a minimum.

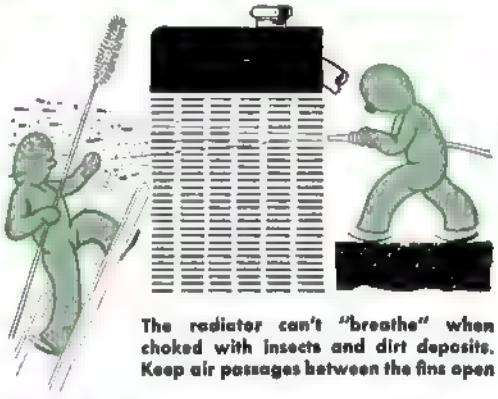
Fan-belt play: A loose fan belt is another source of overheating. If it slips, the fan speed is reduced. If it is too tight, there is excessive wear on the bearings. Adjust the fan pulley so that the belt can be depressed only about ¾ in. as in Fig. 4, and wipe off any grease that would cause the belt to slip.

Blowing out radiator: With dirt, insects and other foreign deposits clogging the air passages in the radiator core, heat dissipation is greatly reduced. Force out such deposits by directing a strong stream of water from a garden hose through the core from the rear. A bug screen is a good investment to keep these passages open.

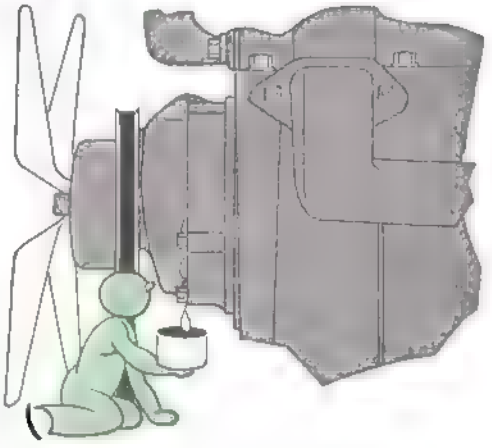
Water-pump leakage: The water pump can be guilty of rust formation, too, by allowing air to enter the cooling system through a leaking packing gland. Oxygen in the air mixing with the cooling water in-



creases rusting of the metal parts. Also, besides losing water along the pump shaft, air sucked in at this point causes a turbulent bubbling action of the water which results in loss through the overflow pipe and consequent overheating. Check for leakage while the engine is running, and repack the gland if necessary. Don't overlook grease and dirt on the engine. Even a thin accumulation acts as insulation and reduces heat radiation. Use a good grease remover, but avoid inflammable solutions and do the job outdoors. Don't start the engine before it has dried thoroughly. A loose cylinder head or a damaged gasket will allow gases, which contain strong corrosive acids, to enter the cooling system and speed the formation of rust. A telltale indication that leaks have developed is the presence of a rusty stain along the seam. Tightening the cylinder-head bolts sometimes will stop such a leak. However, if the gasket is actually broken, it should be replaced. In taking up on the bolts, care should be used to avoid cracking the head by tightening it unevenly. Check the front and rear of the engine water jacket and cylinder-head joint, and also the underside of the bottom tank of the radiator. Internal leaks may not be serious enough to cause loss of liquid into the cylinder or crankcase, but they may allow loss of gas from the combustion chamber into the water jacket. While this is not too serious, it's the gas bubbles in the water jacket that displace liquid and consequently raise the water level above the overflow.

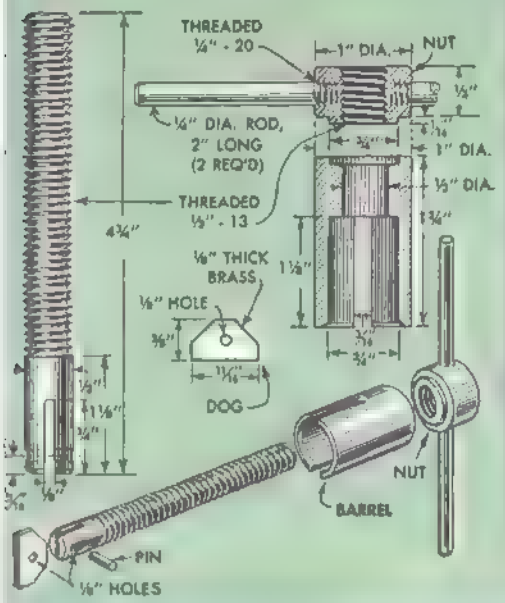


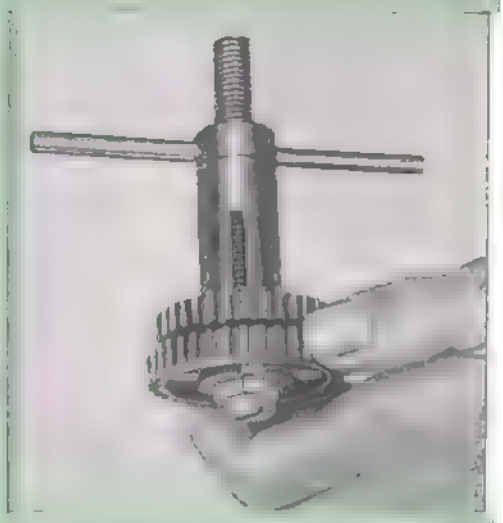
The radiator can't "breathe" when choked with insects and dirt deposits. Keep air passages between the fins open



Watch for possible leaks at the water-pump packing gland. Air sucked in at this point causes water to foam excessively, resulting in loss through overflow

Bushing Puller Makes Gear Changing Easy





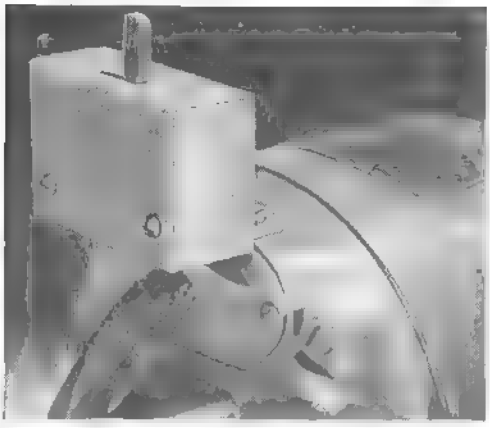
By altering dimensions, this bushing puller can be made up for a wide range of sizes. It gives a straight pull that does not damage the work

On some change-gear lathes it is necessary to pull the bushings of individual gears when making setups for various carriage speeds and for thread cutting. To speed up this job and also to avoid any danger of damaging the parts, make the handy bushing puller, detailed above. It is dimensioned for lathe-gear bushings having a ¾-in. outside diameter and a ½-in. bore. By altering dimensions of the barrel and the threaded puller rod, the tool can be made to fit bushings of other sizes and types. The barrel is turned from cold-rolled steel. The rod must be slightly smaller in diameter than the bore of the bushing and the barrel must be bored slightly larger than the outside diameter of the bushing. Slots in the barrel allow keys on the lathe-gear bushings to pass, but for straight sleeve bushings the slots are not needed. The rod is turned from ½-in. steel shafting and threaded with a ½-13 thread. The unthreaded end is slotted to receive a brass dog pivoted on a pin to allow it to pass through the bushing. Brass or bronze is used for the nut, which is turned with a 1/16-in. shoulder to seat in a counterbore as shown. To use the puller, the nut is turned back on the rod, and the rod, with the dog in the folded position, is passed through the bushing. Then turn the dog to engage the end of the bushing.

Index Mark on Compound Slide Shows Maximum Cross-Feed Limits

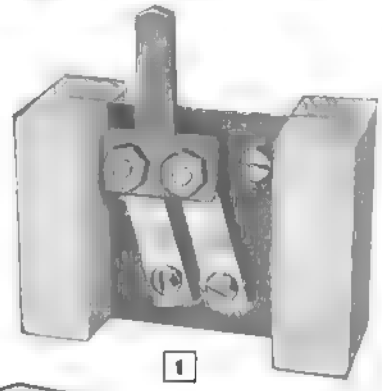
Accidentally backing a compound slide off the feed screw on a metal-turning lathe will not happen if a white index mark is painted on the saddle and the bottom slide of the rest to show the operator the maximum length of the thread. Run the cross-feed out to the limits of the thread before marking. This makes it easy to prevent running out the saddle too far by merely watching the marks and stopping when the two are aligned. This idea is especially helpful when a beginner is unfamiliar with the compound slide. If you wish, the index marks can be made by applying narrow strips of adhesive tape instead of paint to the saddle and bottom slide.

MOTOR DIRECTIONAL "SWITCH"



This inexpensive motor directional "switch" differs from the commercial reversing type in that it is used in conjunction with the motor switch. This feature eliminates the possibility of accidentally starting the machine in the wrong rotation. While a directional switch generally is used in operating a shaper or a metal lathe, such a switch also can be adapted for use where a countershaft or ■ motor is used to drive two machines placed on opposite sides of the drive pulley. This obviates need for crossing the belt.

If the motor is of the split-phase or capacitor type, reversing rotation ordinarily is done by transposing the position of the two starting-coil leads. But when the motor is equipped with this directional switch, the direction of rotation is reversed by just moving a lever. Fig. 1 shows what the switch looks like with the cover removed and Fig. 2 shows the parts and how they go together. To install it on a motor, remove the motor cover plate and disconnect the two starting-coil leads, leaving the motor-switch leads connected. Next, short lengths of wire, connected to the motor terminals, are brought through holes in the cover plate for connection to terminals on the directional switch. The directional switch is connected to the starting-coil leads according to the wiring diagram in Fig. 3 and then mounted on the motor with an angle bracket. Remember that in using this switch, the motor should come to a complete stop before changing the direction of rotation. Positive contact must be maintained to prevent arcing.



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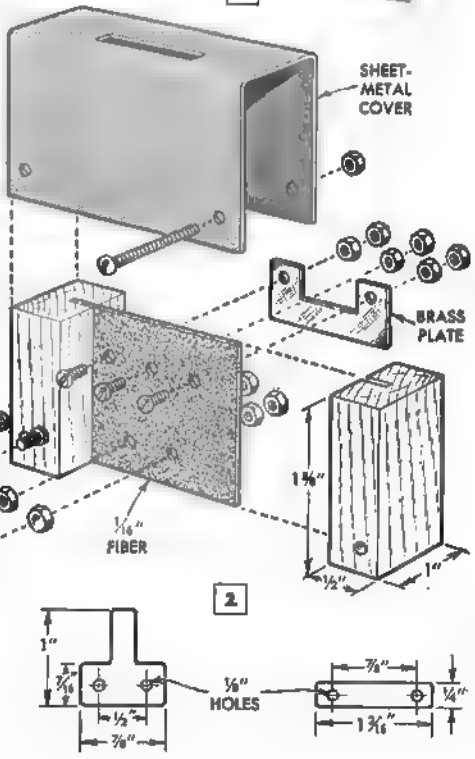
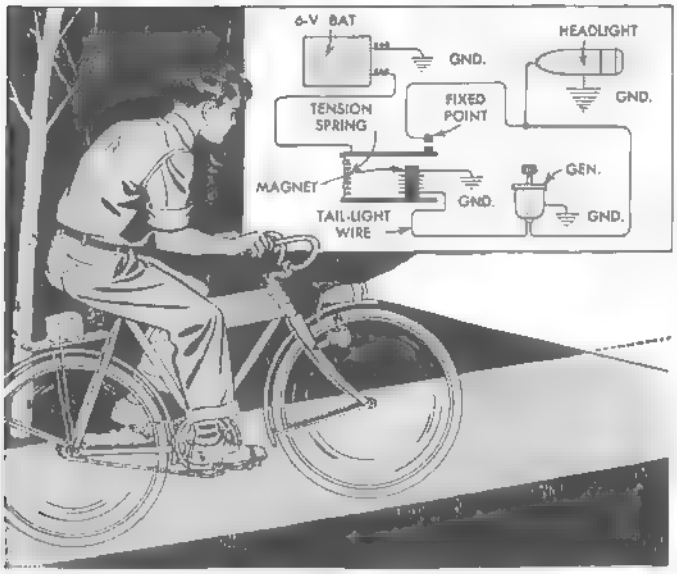


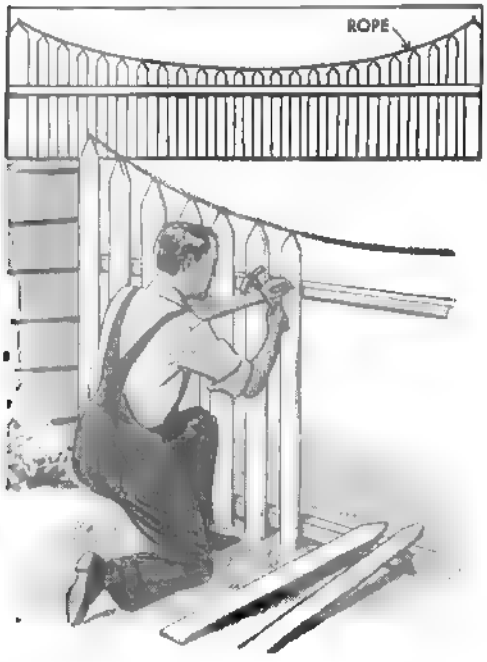
Generator-Operated Bicycle Light Stays Bright



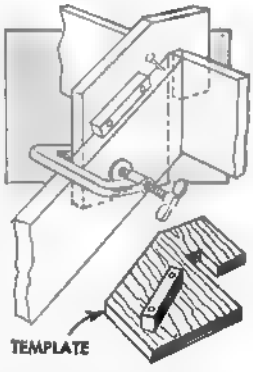
Generator-operated bicycle headlights will remain at constant brilliance when the bicycle is stopped, or slowed down to climb a hill, if ■ 6-volt dry battery and an automotive-type relay are wired into the circiut as shown. The relay cuts in the battery when the generator current drops. The points of the relay will have to be reversed, and when doing this be sure to insulate the fixed point from the relay case. Also, make certain that the armature and battery-lead connection is insulated from the relay tension spring. — Luther E. Brown, Spangler, Pa.

Clothesline Used as Height Gauge in Building Scalloped-Top Fence

To simplify the job of marking and nailing the pickets to the crossrails of a scalloped-top fence, one man suspended a length of rope between the two end pickets of each section and used its natural curve as ■ guide. He first set the end pickets for height by holding a straightedge and level across the top and then drove a nail in the top end of each picket for attaching the rope. The rope not only served as a guide for marking the pickets for length, but was used to line up the tops of the pickets as each one was nailed to the fence rail. The same depth of scallop is maintained for each section by setting all end pickets an equal distance apart and using the same length of rope between the pickets.—Sven E. Siemen, Harvard, Mass.



Rafters Erected Singlehandedly With Aid of Wooden Hook



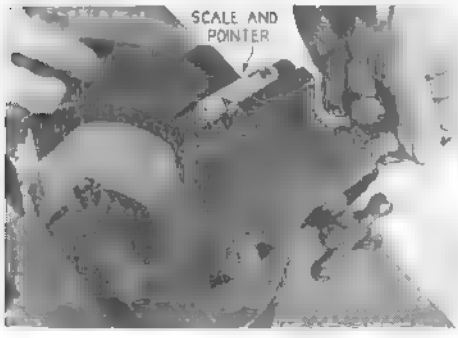
Normally, raising and nailing rafters is a job for two men, one to hold the rafter at the ridge and another to hold it at the plate. However, the job can be done easily by one man if this simple wooden hook is used. It is clamped temporarily to the rafter to permit hooking the plank over the ridge board. Cut the hook from plywood and notch it to suit the thickness of the ridge board. The cleat, which automatically aligns the hook on the rafter, is located to correspond with the roof pitch. The hook also can be used to mark the rafter plumb cut.

Wire Rack on Top of Stepladder Holds Bulbs While Changing

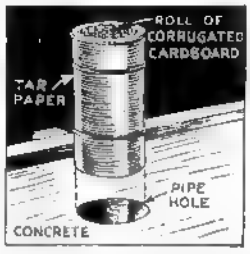
Bent from a length of wire, this simple rack is just the thing to hold lamp bulbs safely on a stepladder when cleaning or changing them in high fixtures. To make it, just form loops in the center of the wire to accommodate five or six bulbs and drill holes in the edge of the ladder top to receive the wire ends. As the rack is merely slipped in place, it can be removed easily.

Fence Scale Handy on a Shaper

An offset scale for your shaper will be found handy, especially when using it as a jointer. The scale can be added to a shaper fence in which the halves are moved along a slide at right angle to the faces. Cut a piece of steel rule and drill the ends for screws so that about 1½ in. of the scale remains for use. Drill and tap corresponding holes in the casting at one side of the slide, and screw the scale to it. Also screw a metal pointer to the casting at the other side. Adjust the fence faces to accurate alignment with a straightedge and set the pointer at zero. Settings for jointing and for full edge moldings will be easy to make.

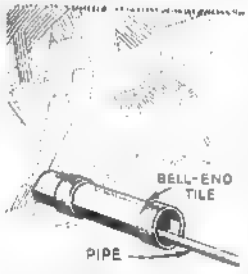


Roll of Cardboard in Concrete Provides Hole for Pipe



Instead of wasting time whittling wooden plugs to certain lengths and sizes to make pipe holes in fresh concrete, roll strips of corrugated cardboard to the required diameter. A layer of tar paper is then added to prevent water in the concrete from softening the cardboard after which the roll is tied with string or held by slipping a couple of rubber bands over the ends.

Water Pipe Laid Inside Tile Is Removed Easily

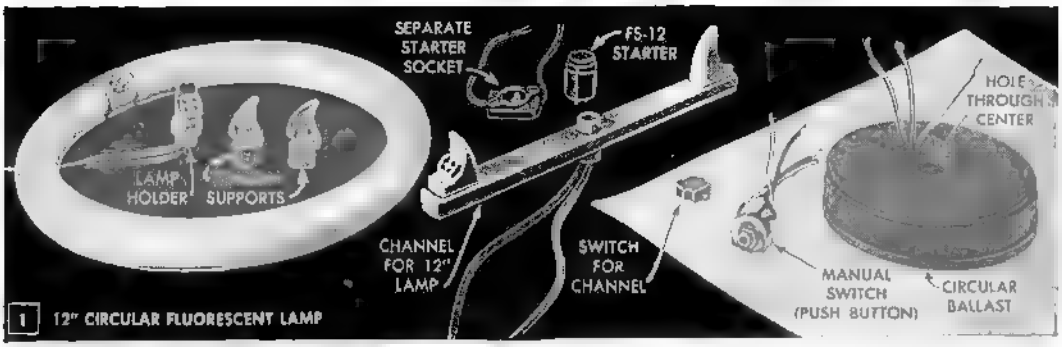


Wishing to connect long runs of pipe to the pressure water system in the basement of his house, one farmer took the precaution of laying the pipe in bell-end tile. This made it an easy job to remove the pipe at any future time in case of freezing, leaks or for any other reason. The tile, of course, should be laid below the normal frost level. In sandy soil, the tile will prevent deterioration of the pipe due to the chemical reaction of sand on iron.

Eyelets Strengthen Model Planes

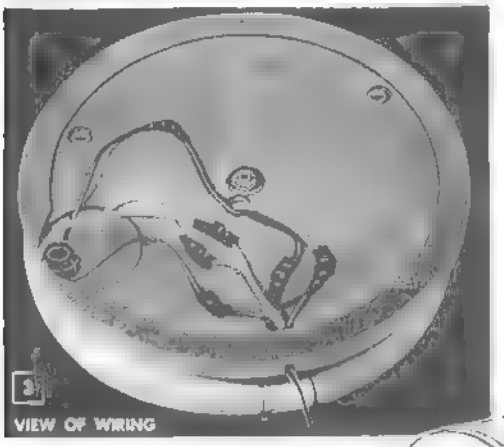
When building self-propelled model airplanes there are many places where control wires or cords have to pass through holes in the soft wood. These holes soon wear so that the wires bind. If shoe eyelets are set in the holes, wear will be avoided, and the controls will work freely.

¶Spread a little petroleum jelly on the threads of an oil-color tube before replacing the cap. This will make it easier to remove the cap.



1 12" CIRCULAR FLUORESCENT LAMP


2 FITTING THE BACK

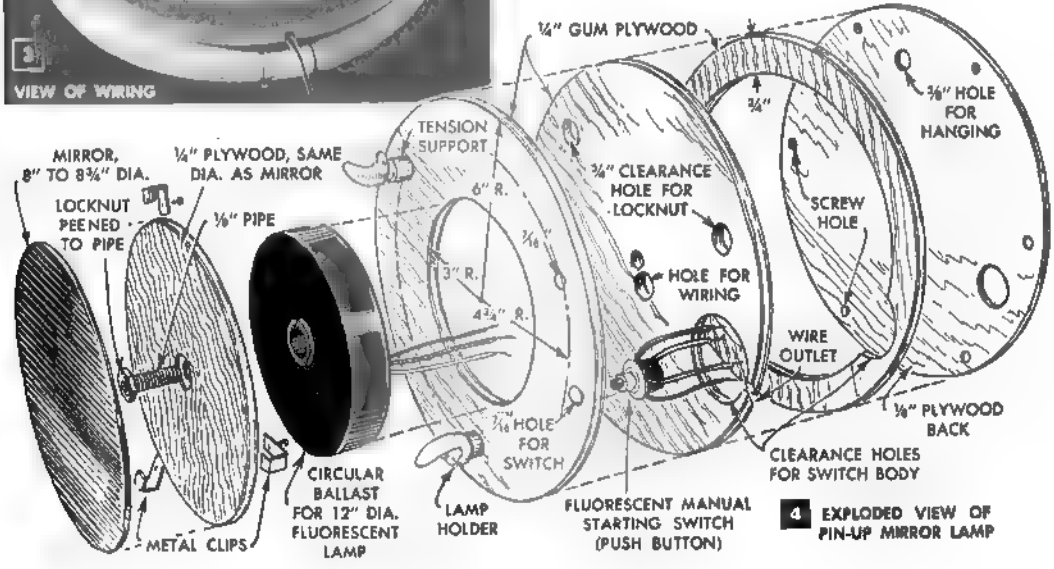

3 VIEW OF WIRING

RINGS OF

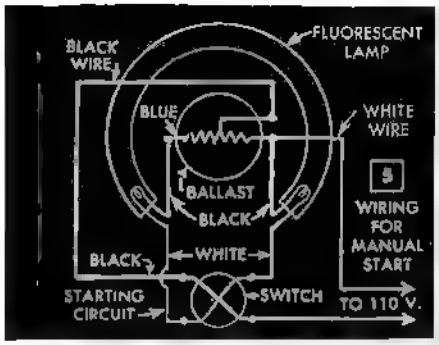
By Sam Brown

CIRCULAR fluorescent lamps offer new possibilities for making special fixtures in more compact and attractive designs than was possible with the long, tubular lamps. Although a complete range of sizes of the new circular lamps is not yet available, simple ceiling and wall fixtures for the small and medium-size lamps can be made by any craftsman.

Circular lamps can be used for large, illuminated magnifiers or opaque projectors, and are excellent, too, for house-number lights, merchandise-display fixtures and illumination for certain power tools. The square ballast can be housed in most ceiling fixtures and is considerably cheaper than the circular type. The mirror style of fixture is excellent for close work like



4 EXPLODED VIEW OF PIN-UP MIRROR LAMP

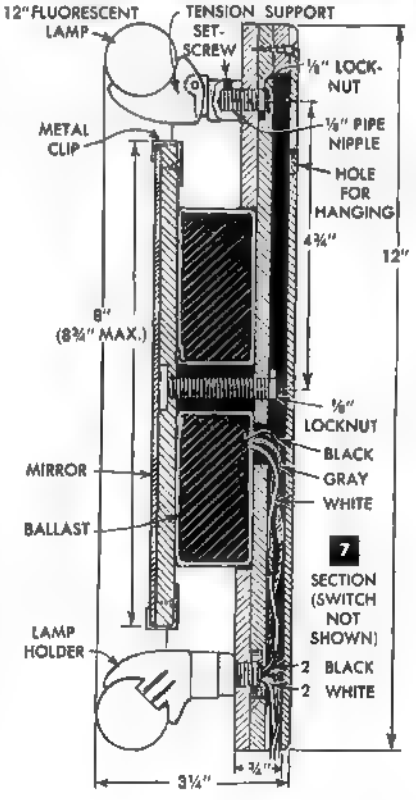


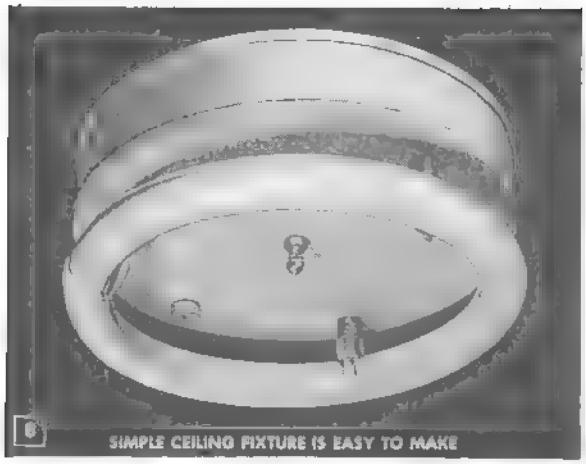
LIGHT

applying make-up. However, it should not be employed as a general long-view mirror unless a special reflector is used, because illumination blacks out the mirror except at close range. Lamps of three sizes nest one within the other, offering scope for added illumination. Single ballasts are available to work these combinations. Lamps also can be arranged in a double deck. Although only three simple fixtures are shown here, anyone can adapt these or design others to fit individual needs, even to use the circular lamps in floor and table units. Study the details carefully and notice how the various parts fit together to form a neat, compact unit.

Parts: Other than lamps, the special parts needed are shown in Fig. 1. The supporting or mounting members for the lamp consist of a fixed lamp holder with four wire leads, and two spring-actuated tension supports. A second type of mounting is the channel, which has one fixed lamp holder and one tension support. A special starter, FS-12, is needed for all fixtures using automatic starting. All units require a special size of ballast, which can be obtained in either the rectangular or circular type. Other parts, such as manual switches and starter sockets, are standard fluorescent-lamp equipment.

Pin-Up Mirror Lamp: Construction of this unit, which is pictured in Fig. 6, is shown in Fig. 4. The unit uses a 12-in. circular lamp. The body or base consists of three rings of ¼-in. plywood, which are glued together after the various openings required have been cut or drilled. Fig. 7 shows how the lamp looks in section, the circular ballast projecting forward and serving as a base for the plywood-backed mirror. Note that the mirror is attached to the plywood backing by means of small metal clips, Fig. 4. These are exposed in the finished fixture so care should be taken to space them equally. The backing piece is counterbored to take ■ standard ⅛-in. locknut which is peened to ■ ⅛-in. pipe nipple. This nipple passes through the plywood backing plate, the circular ballast unit and also the third spacing disk, Fig. 7. In assembling, a locknut turned



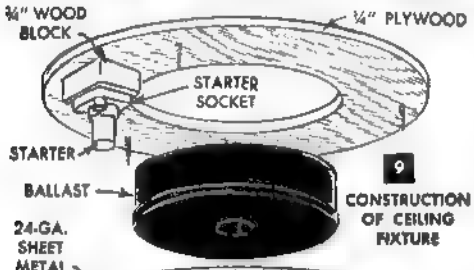


8 SIMPLE CEILING FIXTURE IS EASY TO MAKE

onto the projecting end of the nipple draws the parts tightly together ready for gluing and screwing to the mounting disk and spacer. Finish the edges of the plywood smooth to provide a good base for enamel. The lamp holder and tension supports are spaced equally around a circle having a radius of 4¾ in., mounting being made by means of a pipe nipple and locknut. Fig. 2 shows how the back is fitted. The whole unit is easy to make despite its complex appearance in the drawings. The finish should be white or a pastel shade of enamel. Lamp temperature is about 110 deg. so there is no danger of heat discoloring the finish or causing the wooden parts to catch fire.

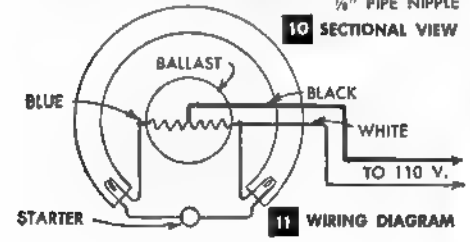
Wiring: The wiring diagram for the pin-up lamp is shown in Fig. 5. The view of the wiring shown in Fig. 3 looks involved, but it really is simple as the various units have colored lead wires. If the small, 8¼-in. circular lamp is used, its low-voltage rating permits it to be used with a simple, series type of ballast. This has two leads, and wiring is just a matter of cutting the ballast into one wire of the power line. Medium and large circular lamps require an auto-transformer type of ballast which has three lead wires.

Ceiling Fixture: A basic type of ceiling fixture consists of a circular mounting frame or body with a 12-in. circular lamp supported by a three-point mounting. Fig. 8 shows a typical unit, excellent for kitchen or game room. This unit employs the automatic starter, and is constructed as indicated in Figs. 9, 10 and 11. Instead of using a sheet-metal rim to enclose the unit, as specified in Fig. 9, the rim of the fixture can be made a solid-wood turning as suggested by the two left-hand details of Fig. 15. Ornamentation of the rim can be done by fluting, turning or carving. If fluting or turning is used, a hardwood that will harmonize with other wood finishes in the room is best but, if the rim is to be carved, it should be made of softwood to simplify the carving job. If desired, you could use aluminum or stainless steel and corrugate or otherwise ornament it. However, the simple base unit shown, with a gleaming

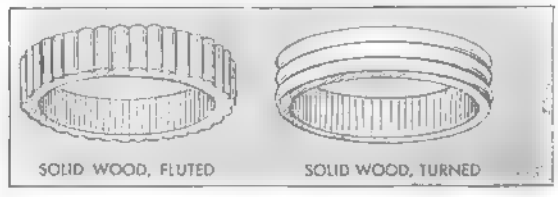


9 CONSTRUCTION OF CEILING FIXTURE

10 SECTIONAL VIEW



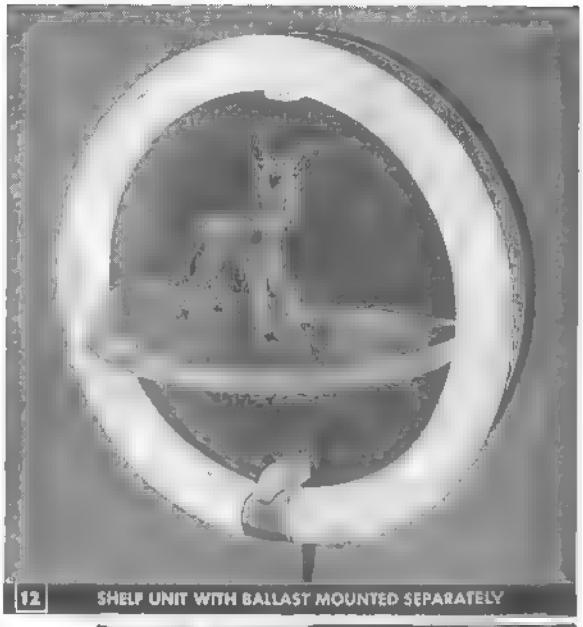
11 WIRING DIAGRAM



white finish, is nice enough for almost any location. This fixture can be flush-mounted, as shown in Fig. 10, or it can be dropped down from the ceiling by using a standard ceiling outlet box as a spacer.

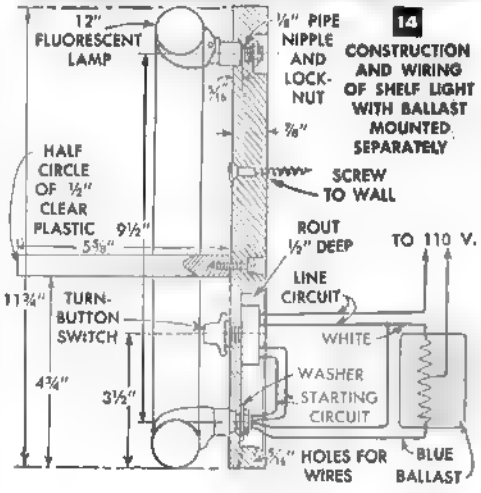
Shelf Fixture: This fixture, shown in Figs. 12, 13 and 14, illustrates a neat idea in a whatnot shelf, and also serves to show the wiring for the medium and large circular lamps when the ballast is mounted some distance from the fixture. As indicated in Fig. 14, three wires run from the fixture to the ballast. With average lamp cord, the ballast can be installed a distance up to 50 ft. from the fixture without any danger. Advantages of this mounting are a more compact fixture, freedom to use the less expensive square or rectangular ballast instead of the circular form, and no ballast hum. With a good ballast, hum is reduced to the minimum. Note in this unit that only two lamp supports are used, this mounting being practical in all cases except where the lamp hangs straight down from the supports. Also note how the over-all extension from the wall is decreased a little by recessing the supports into the base. The plastic shelf is in the form of a full, half circle, cut either from clear plastic or from colored plastic in blue or yellow. The curved edge is highly polished. The shelf is edge-screwed to the wooden backing disk. Take care in drilling and tapping the plastic for the screws, making the diameter of the holes very slightly smaller than the screws. If the screws fit too tightly, they may crack the plastic when driven into it. If they are too small, any weight on the shelf may strip the threads. Do not pull the screws up too tightly as this also may strip them.

Channel Mounting: The channel mounting shown in Fig. 1 is not illustrated with a specific fixture application. This mounting has central connections on both sides for ⅛-in. pipe. In combination with the small 8¼-in. lamp, fixture-making with the channel mounting is almost as simple as making one for a filament-bulb lamp. The ballast is cut into the power line, or a plug-in type of ballast is used.

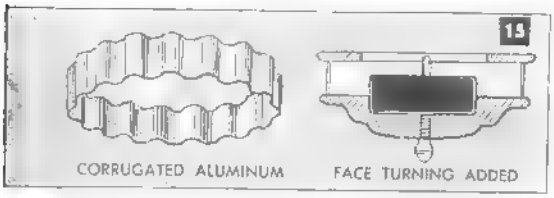


12 SHELF UNIT WITH BALLAST MOUNTED SEPARATELY

13 BACK OF ¾" THICK BASE IS ROUTED FOR WIRING



14 CONSTRUCTION AND WIRING OF SHELF LIGHT WITH BALLAST MOUNTED SEPARATELY



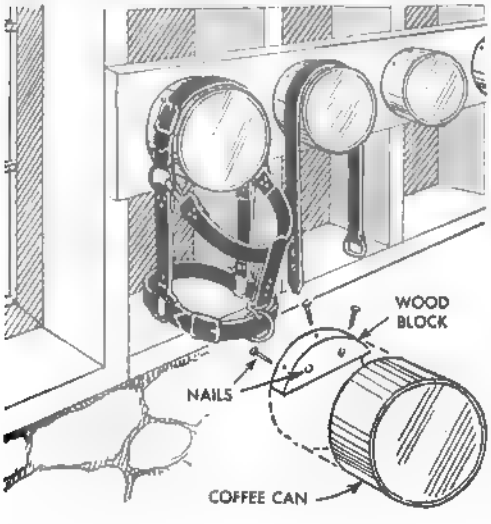
15

Tire-Casing Headrest on Creeper Contains Wiping Cloths

With a section cut from a tire casing, you can make a headrest for an auto creeper that also will provide storage space for wiping cloths. Spread the casing and fasten it to the creeper by means of nails driven through the bead. When stored inside the headrest, cloths are easy to get at and there is room for a good supply.

Coffee-Can Rack Holds Harness

Cut in half and mounted on a board, discarded coffee cans make handy harness racks. Unlike pegs or nails, they will not cause kinks in leather straps. To make the rack, nail a board to the barn studding and then nail on semicircular wood blocks that will fit inside the bottom half of a 1-lb. can of the vacuum-sealed type. After the cans are nailed to the blocks, paint them white so they can be seen easily.



Match Book Checks Spark Plugs

If you ever find it necessary to set the electrodes on a spark plug and have no gauge at hand, an emergency setting may be obtained by using a paper match book as a gauge. The paper used in these books is approximately .020 in. thick, while most spark-plug settings are about .025 in. Therefore, if the electrodes are adjusted so that one side of the book will slide between them with a very slight drag, you will have a plug setting that will do until it can be adjusted with a gauge.

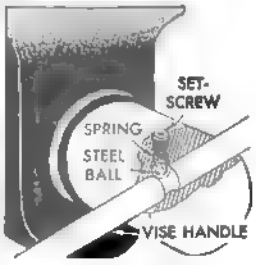
H. Leeper, Canton, Ohio.

Fitting Head Gasket to Save Wear

When replacing the cylinder-head gasket on an auto engine, fit the smooth side against the block and the side that has a rim running around the edges should be next to the cylinder head. Also, when a head is removed for an overhaul or for a blown gasket, look for wearing and grooving. If excessive, plane the head with a special grinder made for that purpose so the gasket will be a good fit.

D. W. Brentlinger, Richmond, Calif.

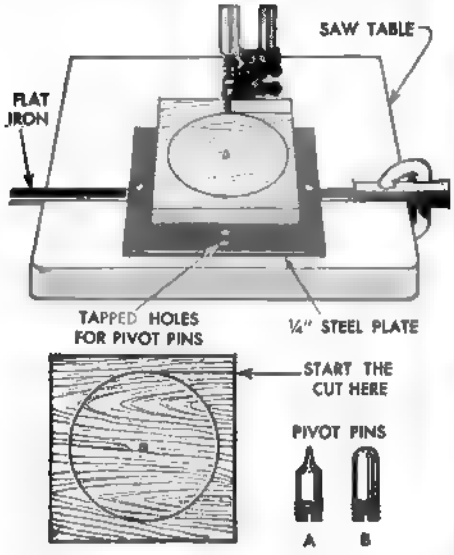
Ball Stop for Vise Handle Speeds Clamping

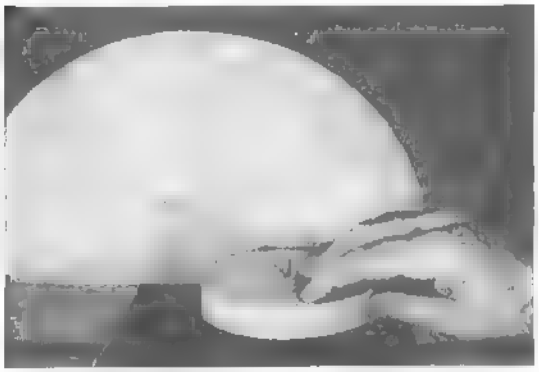


Opening and closing a machinist's vise repeatedly in clamping duplicate parts, is done more rapidly if the vise handle is centered in the vise-screw hub. The detail shows how this is done. Simply insert a steel ball and a small compression spring into a hole drilled and tapped in the screw hub of the vise. These parts are held in place with a socket setscrew. The steel ball engages a concave groove filed in the vise handle around the center. The spring should exert sufficient pressure to hold the ball in the groove and yet allow the handle to slide.

Nathan Bogoch, Winnipeg, Man., Can.

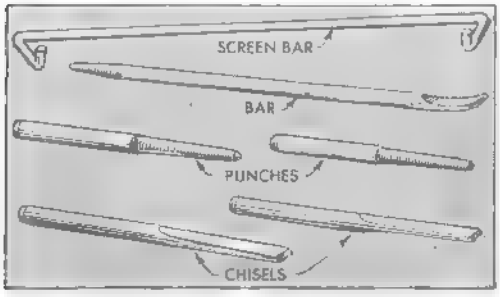
Circle-Cutting Jig Slides in Saw-Table Groove





Cutting out wooden disks on a bandsaw or accurately finishing them on a sander becomes a quick, accurate operation when this sliding pivot jig is used. It consists of a steel base fastened to a length of flat iron, the latter sliding snugly in the miter-gauge groove of the saw or disk-sander table. A row of holes spaced to handle a variety of disk sizes is drilled and tapped across the base, as shown, to take threaded pivot pins, A and B. Pin A is for stock in which a hole has not been drilled, and B is for drilled stock. A stop is clamped in the end of the table groove to align the pivot pin correctly at a 90-deg. angle with the cutting edge of the saw blade. The sliding feature allows the jig to be pulled away from the saw blade or sanding disk for mounting and removing the work. For use on the bandsaw, the work is mounted and the jig is pushed forward, permitting the saw to take a straight cut into the wood. Then, when the stop is reached, the work is rotated on the pivot and the disk sawed. The jig operates similarly on the sander and is readily moved to any position, thus avoiding loading of the sandpaper at any one point. If the bandsaw or sander table does not have a miter-gauge groove, the jig may still be used by attaching a guide strip to its base so that it overhangs and rides against the edge of the table. A stop can be clamped to the table top.

John P. Arnold, Doylestown, Pa.

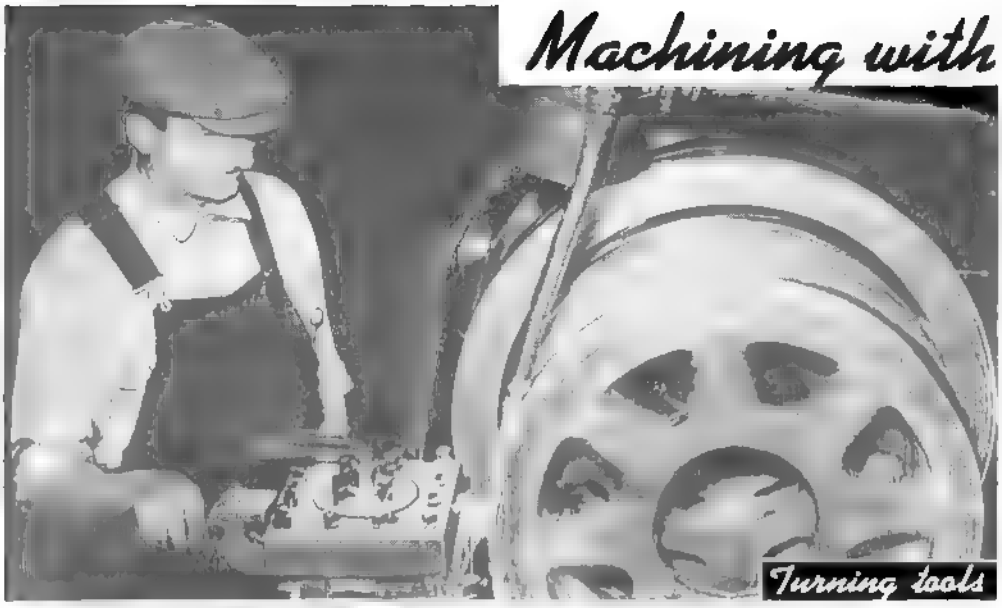


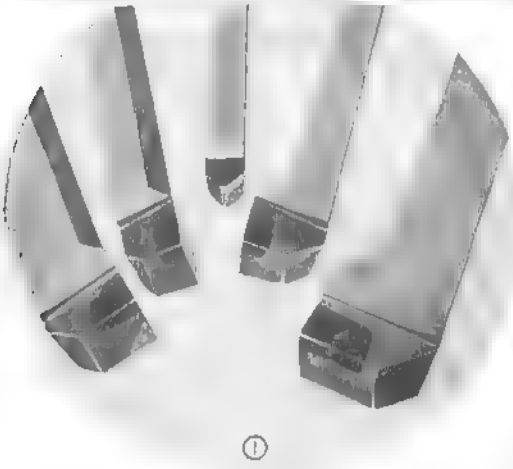
Bars From Potato-Grading Unit Used to Make Hand Tools

Round, spring-steel bars of the type used on potato-grading equipment, provide excellent material from which to make a variety of small tools needed around the farm or shop. The bars usually have a diameter of ½ or ⅝ in., and being of high-carbon steel they are exceptionally suitable for pry bars, chisels, punches and similar tools.

Earl R. Goddard, Denver, Colo.

Machining with





Capable of withstanding excessive loads and extreme wear at increased speeds and feeds, carbide tips on all kinds of machine tools enable today's fast and steady stream of production at reduced tool cost. This article gives basic information on the use and care of carbide-tipped tools; tells how to grind and lap the cutting edges for greatest efficiency, how to braze tips to shanks, and contains other essential data that every machinist should know

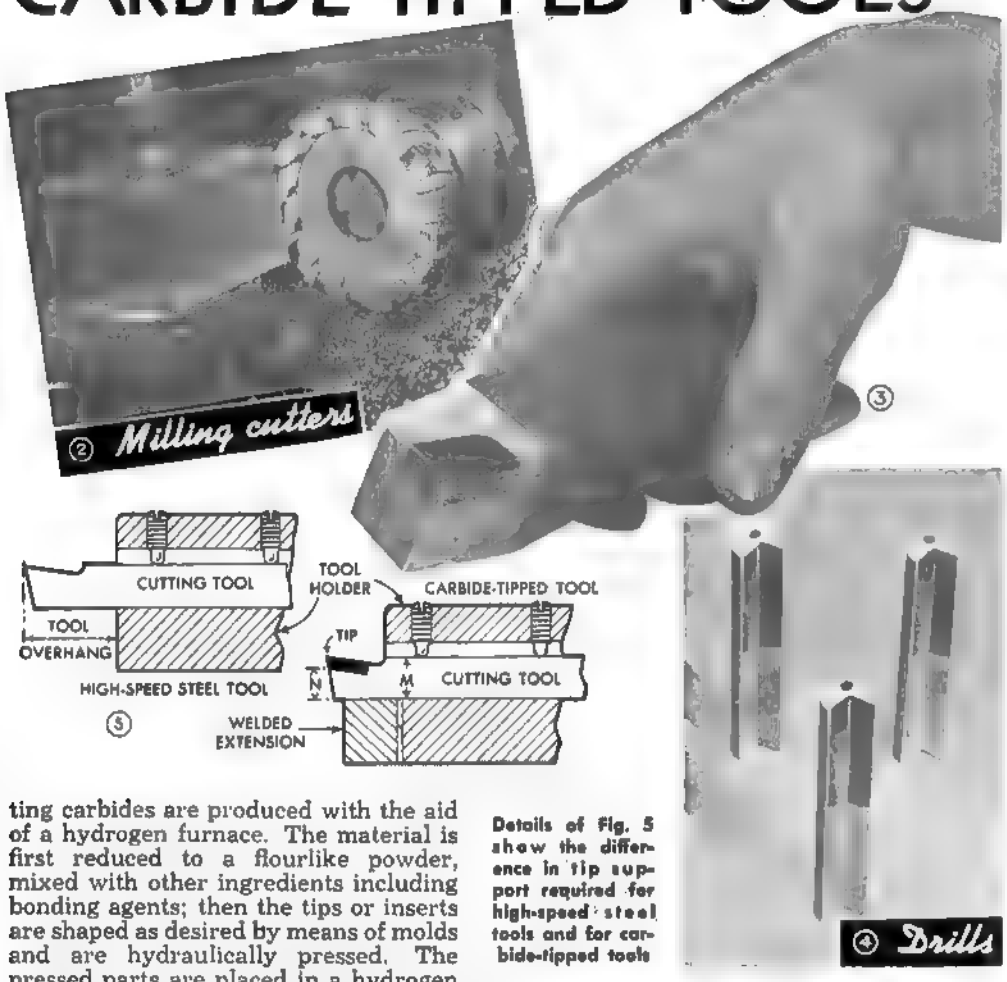
By H. J. Chamberland

OVER fifty percent of all industrial machining operations are performed with various types of cutting tools tipped with carbide. When properly designed, correctly ground and so maintained, carbide-tipped tools never fail if there is adequate power to carry them along. The vertical boring mill shown in Fig. 16 removes chips at the rate of more than 600 lbs. per hour, and the one shown in Fig. 22 was photographed when turning a pulley 10 ft. in diameter. Speeds and feeds are dependent on the nature of the material being machined and the cuts desired, but can be increased substantially over those of high-speed steel tools, and the tool cost can be reduced considerably.

Have many uses: Available under various trade names, carbide tools are extremely hard and very brittle. Originally intended to machine cast iron or castings with hard scales, today these tools are being used to machine nearly all materials, especially where cutting loads and wear are excessive. In common use are not only carbide-tipped lathe tools, such as the assortment shown in Fig. 1, and milling cutters, Fig. 2, but also carbide-tipped twist drills, reamers and related tools, as well as many taps. Also, many micrometers and gauges have carbide contact points. Carbide-tipped tail centers in lathes will outwear twenty to thirty high-speed steel centers. Some solid carbide drills used for gun-barrel drilling are shown in Fig. 4.

How tips are made: Tungsten-titanium carbide is unlike other metals that are fused or cast: It is only one-half as strong as high-speed steel but its hardness is a close second to that of the diamond. Cut-

CARBIDE-TIPPED TOOLS



Details of Fig. 5 show the difference in tip support required for high-speed steel tools and for carbide-tipped tools

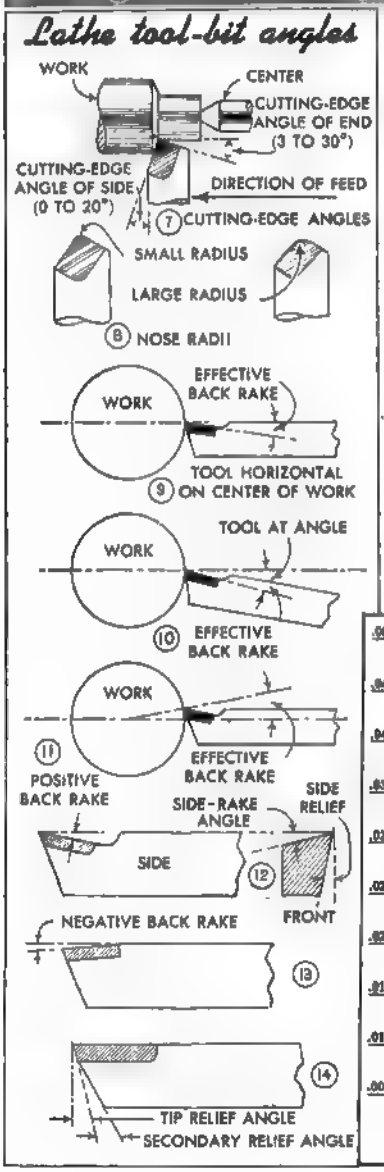
ting carbides are produced with the aid of a hydrogen furnace. The material is first reduced to a flourlike powder, mixed with other ingredients including bonding agents; then the tips or inserts are shaped as desired by means of molds and are hydraulically pressed. The pressed parts are placed in a hydrogen furnace for a primary sintering or heat treatment to harden them so that they can be machined easily. After machining, they are returned to the hydrogen furnace in receptacles called "boats" for final sintering or hardening. Upon removal from the furnace this time the parts are diamond hard and ready to be brazed to tool shanks or bodies. The tips are available in various grades and, while one particular grade may prove quite effective for the general run of work, it is most economical to use the grade adapted to a particular material.

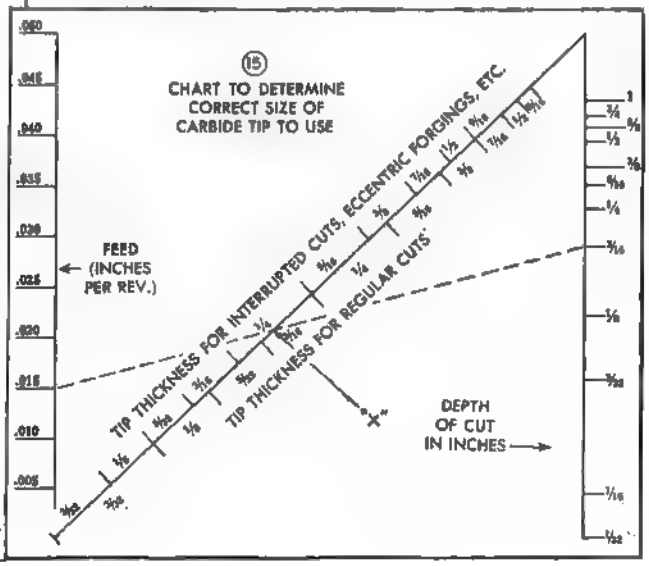
Tips require rigid support: An ordinary cutting tool is made of some material that can be hardened for cutting and possesses sufficient strength to withstand cutting loads. A carbide-tipped tool consists of a carbide tip as the hardness member and a steel shank as the strength member. As shown in the left detail of Fig. 5, a solid high-speed steel tool can stand a substantial amount of overhang with rigidity but, as shown in the right detail of Fig. 5, a carbide-tipped tool must have a minimum amount of overhang even if it means welding an extension to the tool holder to provide adequate support. Although a carbide tip is very hard, resists wear, holds its cutting edge at high temperatures and allows for surprisingly great machining speeds and feeds, it has very little elasticity. For this reason, it is imperative that the shank and tool holder be made sufficiently strong to prevent bending or giving in the least. Accordingly, dimension N in the right detail of Fig. 5, acting as a tip support, should equal dimension M as closely as possible.

Estimating tip size: A current mistake often made in many machine shops is to estimate the size of the tip incorrectly for a given job and to select a shank that is too weak. The chart shown in Fig. 15 simplifies this problem and is worth while under-

standing thoroughly. In order to use the chart, first determine the depth of the cut to be made and locate this on the right-hand scale. Then locate the feed per revolution on the left-hand scale. Next, lay a straightedge across both of the located points and read the size tip required where the straightedge crosses the solid diagonal line marked X. For example, the dash line in Fig. 15 represents a straightedge line, and the point where it crosses line X indicates that a 5/16 to 1/4-in. tip should be used if the feed is .015 in. per revolution and the depth of cut is 5/16 inch. The general requirements to determine the size of the shank are as follows: The deeper the cut, the higher the feed and the more overhang, the heavier will be the shank that is required. Having selected the correct size of tip, it is not difficult to estimate a shank of proper size.

Cutting-edge angles: The design or shape of carbide-tipped tools involves correct side cutting-edge angles, and cutting-edge angles and nose radii, which are all directly related to rake angles. All these should be correlated in order to produce a tool that is most efficient for cutting. As shown in Fig. 7, the side cutting-edge or lead angle, varies from 0 to 20 degrees, depending upon the nature of the cut to be made. Machining to a shoulder requires an angle of only a few degrees, usually 2 degrees. For other work it is advisable to try 15 degrees as a starting point and reduce or increase by experiment. When starting or taking interrupted cuts with a tool having a side cutting-edge angle from 5 to 15 degrees, the load is taken on the tip or point back of the nose where the tool is strongest. A gradual reduction of cutting load eliminates chipping the tip, especially on large-diameter work. The length of the cutting edge is increased so that the pressure per unit of area





on the cutting edge is reduced.

For highest cutting efficiency, the point of contact of carbide-tipped tools should be as small as possible. A 1/32 to 1/16-in. nose radius has been found adequate. As shown in Fig. 8, the larger the nose radius, the smaller the wedge angle will be, and the more pressure is needed between the work and the tool. Increased pressure and drag are detrimental to tool life. Also, chatter usually occurs with too large a nose radius. Although the average angle for the end cutting edge varies from 8 to 15 degrees, it may be as much as 20 to 30 degrees on certain jobs. An angle of less than 8 degrees here may invite chatter due to the nose of the tool being gradually flattened by repeated grindings.

Rake angles are of no less importance to obtain a free-cutting tool, although at times a tool that cuts too freely will not break the chips. In determining rake angles, it is understood that the nose of the tool contacts the work with the shank set at right angles to the work as shown in Fig. 9. When a set-up involves a tool shank held at an angle with a line drawn between the center of the work and the tool contact point as in Figs. 10 and 11, the rake angle should be changed accordingly. Fig. 12 shows a positive back rake and also side rake. As the tool is reground, shims must be used to bring the cutting edge of the tool to correct position. A negative back rake, shown in Fig. 13, allows for wider distribution of the load over the tip area. Negative back rakes vary from 2 to 8 degrees, 5 degrees being considered as a starting or experimental point. When a negative back rake is used, other rake angles should be several degrees greater but of the positive variety. Tools must have tip relief also as shown in Fig. 14.

Carbide-tipped tool in this boring mill removes large chips of steel at rate of over 600 lbs. per hour

WHEEL RECOMMENDATIONS FOR GRINDING AND LAPPING CARBIDE-TIPPED TOOLS (17)

		Carborundum	Norton
For Grinding Steel Shanks Only			
ALUMINUM-OXIDE WHEELS	Roughing	24M200	1924L
	Finishing	401K-200	1946M
For Grinding Steel Shank and Tip Simultaneously			
SILICON-CARBIDE WHEELS	Roughing	G-60RW	3960/1-17
	Finishing	G-100SW	39100/1-H7
For Lapping Carbide Tip Only			
DIAMOND-IMPREGNATED WHEELS	Average finish	100 Grit	100 Grit
	Average lap	240 Grit	220 Grit
	Fine lap	320 Grit	320 Grit

Chip breakers: Machining of steel presents the problem of a continuous chip, especially at cutting speeds exceeding 250 feet per minute. The chip must be broken into relatively short lengths for safe and economical disposal, which is accomplished by means of a chip breaker, ground in and adjacent to the cutting edge of the tool as shown in Figs. 3 and 20. Chip-breaker grinding must be done on a diamond-impregnated wheel as no other wheel will cut and give the desired fine finish. Fig. 18 illustrates the correct holding position for grinding chip breakers freehand, while the table in Fig. 19 gives the various widths of chip breakers as computed on the basis of depth of cut and extent of feed involved.

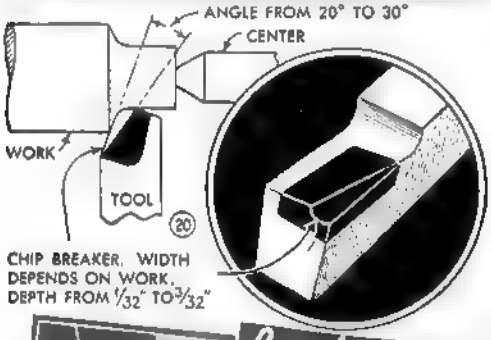
How to grind and lap tips: A grinding wheel used for steel will not cut carbide and vice versa, so keeping carbide-tipped tools in good condition requires a special sharpening technique. After some experience, you will be able to grind them freehand if ample hand support is provided. When the angle of the shank needs regrinding, an aluminum-oxide wheel must be used. When grinding tip and shank angles simultaneously, a silicon-carbide wheel is imperative. To produce final, fine

Chip breakers

(19) WIDTH OF CHIP BREAKERS

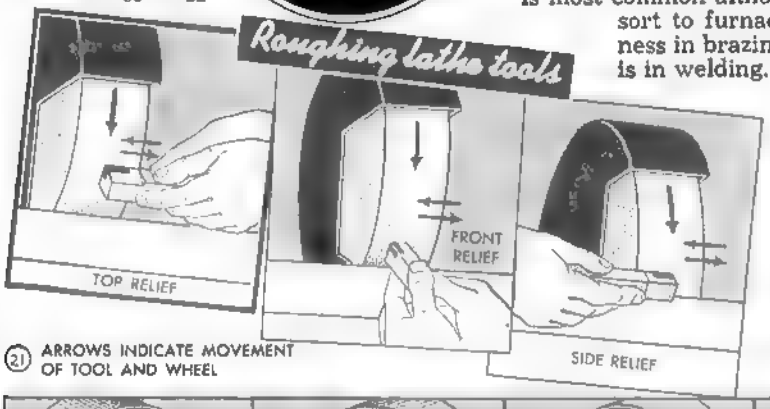
Depth of cut in inches	Feed in inches per revolution			
	.008 to .012	.013 to .017	.018 to .022	.023 to .027
	chip-breaker widths			
1/64 to 3/64	1/16	3/64	3/32	1/64
1/16 to 1/4	3/32	1/8	3/32	5/64
5/64 to 1/2	1/8	5/32	7/64	3/32
3/16 to 3/4	5/32	7/64	1/32	1/8

Note: A chip-breaker depth of .020 in. usually satisfactory for most steel



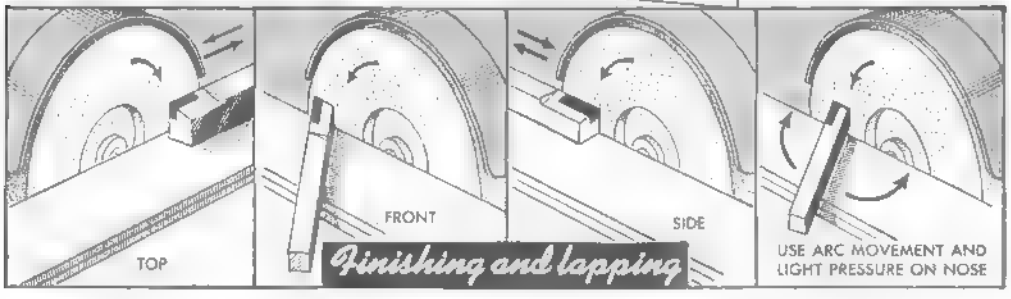
finishes on the carbide tip, nothing but a diamond-impregnated wheel will do. Fig. 6 shows a tool being lapped with a diamond-impregnated wheel. Fig. 21 gives the various steps in roughing in, finishing and lapping lathe cutting tools. For roughing, which is done on the front of the wheel, the top face is first, then the front relief and finally the side relief. In the finishing or intermediate operations, done on the side of the wheel, the sequence is the same, but for the lapping operations, also done on the side of the wheel, the top face is first, then the side relief, followed by the front relief. Lapping the nose of the tool is accomplished by moving it in an arc, back and forth, applying a very light pressure. Fig. 17 gives recommendations for various grades of wheels to use to keep carbide-tipped tools at their maximum cutting efficiency.

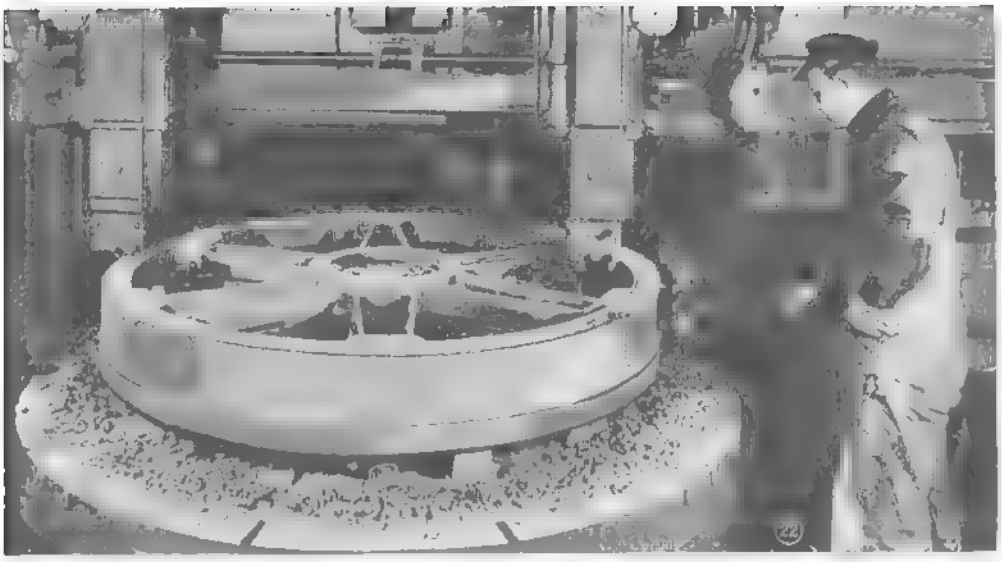
Brazing tips to shanks: Carbide tips can be brazed to tool shanks in most shops economically. Torch-brazing, as in Fig. 23, is most common although many shops resort to furnace-brazing. Cleanliness in brazing is as essential as it is in welding. Therefore, all parts



(21) ARROWS INDICATE MOVEMENT OF TOOL AND WHEEL

Work and time spent in keeping tool bits sharp will pay "dividends" in increased production. At the left are several steps involved in roughing lathe tool bits and below are shown the operations of finishing and lapping them





In this immense boring mill, two heavy carbide-tipped tools are used to machine a pulley 10 ft. in diameter

should be cleaned thoroughly with carbon tetrachloride beforehand. Silver makes a dependable braze, both the carbide tip and the shank being tinned as in Fig. 24. It is customary also to braze tips as shown in Fig. 25 with a special brazing sheet of copper or similar alloy. Multi-tip brazing can be performed easily by following the method shown in Fig. 26. In all cases the radius of the edge of the tip, where it fits into the milled portion of the shank, should be larger than that on the shank. High-silicon steels and straight carbon steels with a high carbon content should be used for shanks. The torch should be adjusted to deliver a nonoxidizing flame, and it should be kept moving back and forth to avoid burning the shank. It is advisable to preheat the work by applying the flame to the sides and bottom of the shank, then carefully to the tip. When furnace-brazing, the tool shank is preheated in a muffle furnace to 1,600 degrees Fahr., with an ample supply of borax covering the milled section. Scraping should be done immediately after removing the work from the furnace. The tip is similarly preheated but to 2,200 degrees Fahr., after placing a sheet of brazing foil over the blank and covering thoroughly with borax. When the sheet melts and flows freely, the tip is removed from the furnace as quickly as possible, is positioned on the shank and pressed in tightly. Regardless of the brazing method used, the work always should be cooled by air—never by immersing it in water.

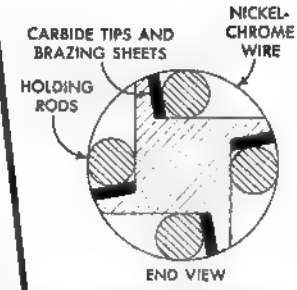
Some plants prefer using tools on which the carbide tips are clamped to the shanks as illustrated in Fig. 27, the claim being made that there is less breakage due to the absence of brazing strains. This method permits tips to be changed from one holder to another and also simplifies the work of grinding them. It has been reported that twice as many pieces of work per grind becomes possible by adopting this method of holding tips to shanks.

Coolant: A coolant is recommended when using carbide-tipped tools to machine steel, aluminum, brass and many grades of ferrous castings of the close-grain variety. The latter form chips in lengths rather than powdery chips as from the gray irons. It is imperative that a tank, pump and supply line of sufficient capacity be provided to give a large volume flow of soluble oil at a high velocity. Any rise in temperature that will offset the effectiveness of the coolant must be avoided. In numerous cases, the coolant is directed from the top and bottom, or from both sides of the tools. Sometimes tool blocks are drilled for pipe

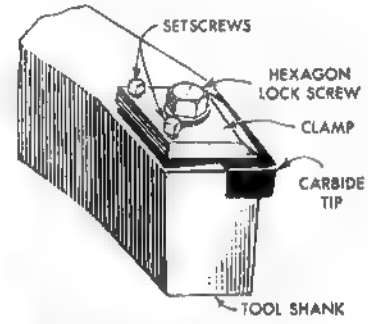
Don't

1—hammer cutting tips in any way
2—dip tool in any liquid while hot
3—stop spindle without disengaging feed
4—use an overhang beyond absolute minimum
5—spare coolant when and if it is required
6—lay a carbide-tipped tool on a machine bed
7—use any but silicon-carbide or diamond wheels
8—use any but dog-point and flat clamping screws
9—use tools too long before stoning or sharpening
10—have tool against work when tightening clamp screws
11—press carbide tip against wheel but traverse lightly
12—use a holder not expressly designed for carbide tools

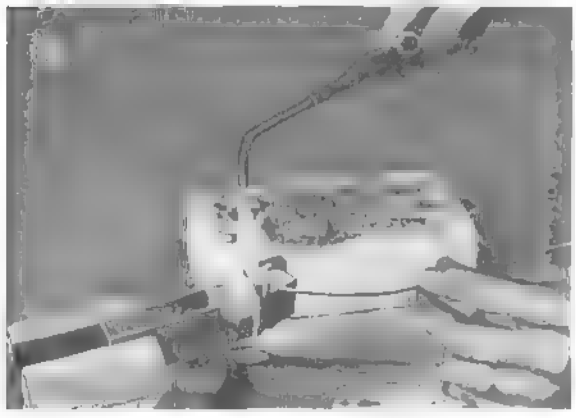
Brazing carbide tips



26 TORCH-BRAZING CARBIDE TIPS IN MULTIPLES



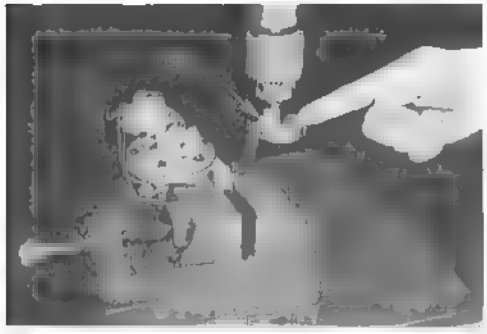
27 STRAP-ON STYLE CARBIDE-TIPPED TOOL



connections to provide an unobstructed flow of coolant directly to the nose of the tool. Always be sure to select a coolant that is best suited to the particular kind of metal being machined and to operating conditions such as speed and the depth of the cut.

Testing Operation of an Auto Fuel Pump on a Drill Press

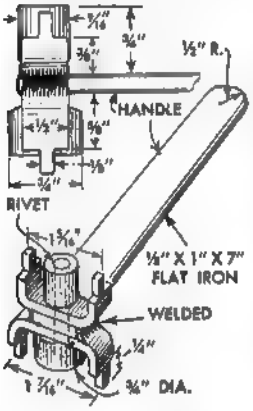
It is always a good idea to test a fuel pump before installation to assure that it is operating correctly. Such a test can be made by clamping the pump in a vise which is fastened securely on the table of a drill press, as shown. Then the drill press is operated at its lowest speed, using a threading die in the chuck to function as a pump-operating cam. Any large die can be secured to a ⅜-in. bolt passed through one of the clearance holes to provide an eccentric action. In this setup, the pump will operate in a normal manner, and by connecting lines to the intake and outlet of the pump its ability to lift fuel will be demonstrated. Any pump that cannot lift gasoline to a height of 3 ft., and then force it up another 3 ft. should be checked for leaky valves, defective diaphragm, or weak springs. If there should be any sign of leakage at the pump during this test, the necessary repairs should be made and the pump given another test before it is installed on the car.



Dyed Door Mat Simulates Grass for Lawn-Mower Window Display

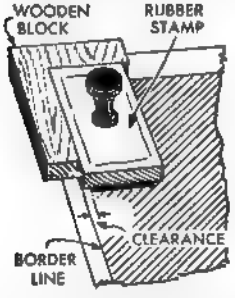
Looking for a novel way to display lawn mowers, one hardware dealer dyed a door mat bright green, to simulate close-cropped grass, and set the mower on it in his show window. This arrangement, which is economical in cost, attracted considerable attention. The same idea could be used for other lawn and garden equipment.

Special Wrench Speeds Tightening Of Conduit Locknuts



Not satisfied with the hammer-and-screwdriver method of tightening the thin locknuts on conduit connectors, Joseph Marino of Chicago devised this special wrench which does the trick in a jiffy. The wrench has two guides which fit both thin-wall and rigid-type conduit connectors. It is used by inserting the proper guide in the conduit connector after the locknut is started with the fingers. Two prongs on the wrench engage the lugs on the nut and permit drawing it up tightly against the outlet box. Both heads of the wrench are the same design but of different size. They are riveted and then tack welded to a suitable flat-iron handle. If the guides are grooved lengthwise, the wrench can be used to loosen nuts where wires are in place.

Try Square Aligns Rubber Stamp When Printing Data on Tracing



For draftsmen who use a rubber stamp to print the necessary information on a blueprint tracing, a try square cut from a wooden block will simplify aligning the stamp with the border of the tracing. As the lettering usually does not extend to the lower edge of the stamp, this must be taken into consideration when locating the try square.

W. B. Eagan, Louisville, Ky.

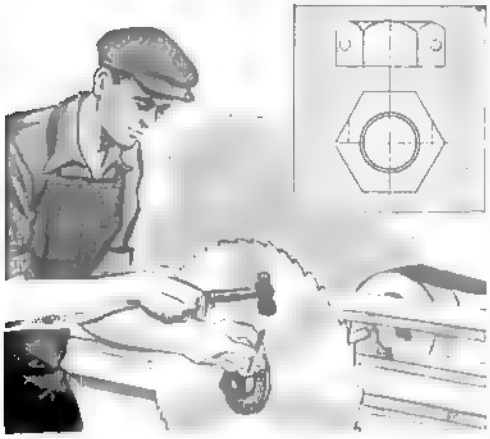
Tank Cart Speeds Mixing Liquid Used in Tractor Tires

To facilitate the job of filling tractor tires with liquid when extra weight is desired or when adding an antifreeze solution to the tires, one service station rigged up this handy mixing cart. It is nothing more than two 55-gal. oil drums anchored to a caster-fitted platform, and is used to mix thoroughly calcium chloride and water by pumping the solution from one tank to the other several times. This speeds

mixing, after which the solution is pumped into the tires. The amount of chemical used is varied according to the manufacturer. Avoid using a solution consisting of common table salt and water for an antifreeze, as the salt will separate from the water and permit the water to freeze and damage the tire.

W. N. Skourup, Jr., Columbia, Mo.

Lands on Facets of Mandrel Nut Prevent Punch From Slipping



Skinned knuckles resulting when using a hammer and punch to tighten or loosen a saw-mandrel nut that is too big to turn with a wrench, led one man to provide lands in the nut so that the punch would not slip off. The lands can be formed by milling a shallow notch or grinding a flat in opposite facets of the nut as shown.

Flat-Topped Sunshade for Hogs Moved by Small Tractor

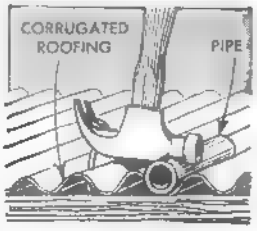
This sunshade is easy to build and it's moved about from range to range merely by hitching to a small tractor. The runners are made from 4 by 4-in. stock rounded at the ends, and are fastened to the vertical posts by pieces of flat iron bolted in place. The roof is made from rough boards covered with roll roofing or sheets of corrugated-metal roofing.

A. M. Wettach, Mt. Pleasant, Iowa.

Silicon-Carbide Dispenser

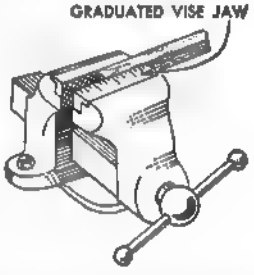
Small talcum-powder cans provide ideal dispensers for silicon carbide or similar abrasives. If several grades of the abrasive are used, label each can with the grit size it contains. The holes in the top of most of these cans may be used to control the flow of the material.

Removing Corrugated Roofing In Usable Condition



If corrugated metal roofing or sheathing is to be removed from a building and used again, the nails can be pulled without damage to the roofing by using a short length of pipe as a fulcrum block as shown in the drawing. This method is especially helpful when dismantling shed-type buildings and salvaging the materials.

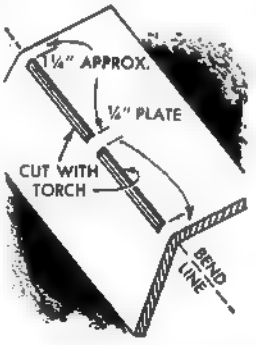
Bench Vise With Calibrated Jaw Speeds Small Cutoff Jobs



Measuring and cutting off short pieces of stock is speeded up by scribing an inch scale on the vise jaw, inserting the material to the required dimension, and sawing it flush with the end of the jaws. As this method is not intended for especially accurate work, divisions of ¼ in. will be found suitable for most jobs.

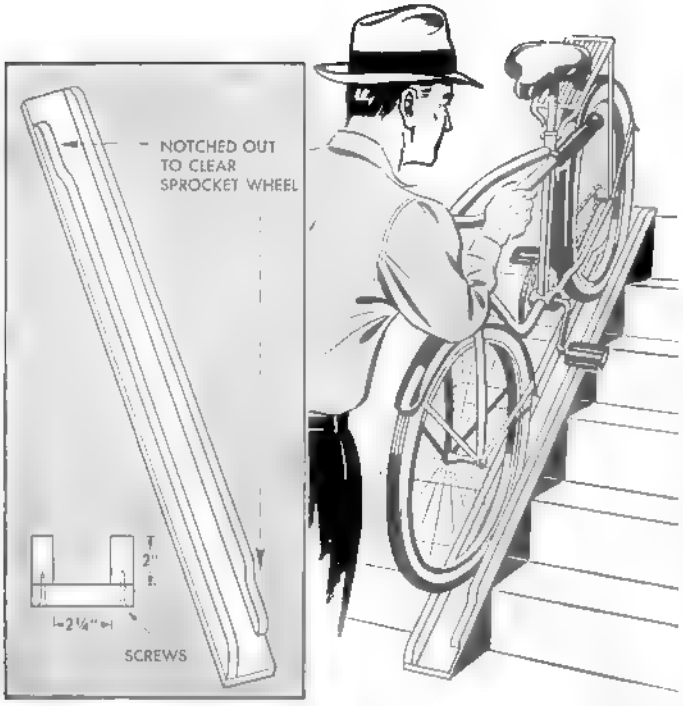
Ronald Eyrich, Milwaukee, Wis.

Slots Cut Through Steel Plate Aid Bending It



A piece of ¼-in. steel plate can be bent in a vise with comparative ease and without the usual equipment, if it is first slotted along the bend line with a torch. Leave about 1¼ in. of material between each slot and at the ends. Should it be necessary to strengthen the plate after bending, fill the V-shaped channels formed by the slots with welding rod.

Earl R. Goddard, Denver, Colo.



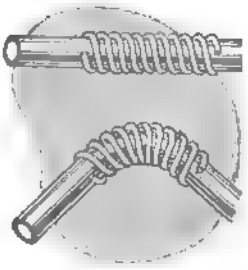
Channel Runway Aids Wheeling Bike Up or Down Steps

If a bicycle is stored in a basement or on a porch, this portable wooden runway will facilitate wheeling it up and down the steps. While the length of the runway, of course, should suit the particular stairway, the sectional dimensions given will accommodate most bicycles. Note that opposite sides of the runway are cut down at each end to clear the sprocket wheel and mud guard. If both ends are cut alike, it makes no difference which end is placed at the top of the stairs. In wheeling the bicycle up or down the runway, it is more convenient to hold it by the handlebars.

Quick-Change Attachment for Pin-End Blades Fits Scrollsaw Chuck

When making internal cuts in intricate scrollsaw work, the bother of loosening the clamping screw in the upper blade chuck to release the blade is eliminated if the chuck is fitted with this auxiliary attachment. It is designed for use with pin-end blades and is made from sheet metal, folded double. One end is spread apart to take the end of the blade and notched as shown. To release the blade from the attachment it is only necessary to pull down on the plunger to relieve tension and then unhook the blade. The pin in the lower end of the blade must be removed so that it can be clamped in the lower chuck in the regular manner. The teeth should point downward.

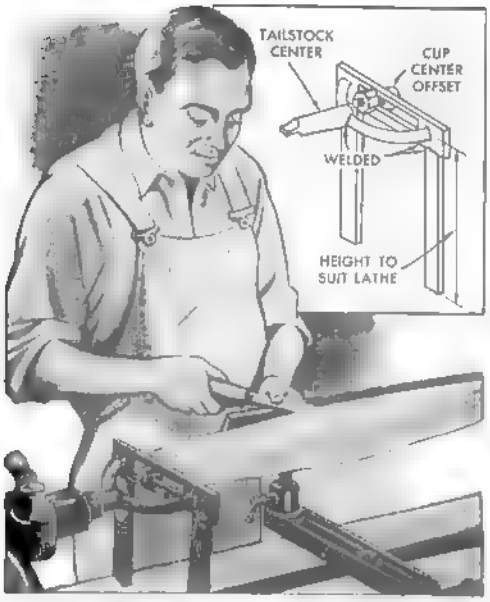
Copper Tubing Bent Without Kinking



Where it is necessary to make sharp bends in copper tubing to fit special requirements, one mechanic finds that a coil spring is more convenient to use than filling the tubing with sand to prevent it from kinking. A snug-fitting coil spring is pushed over the place to be bent, and after the bend is made it is readily slipped off.

G. E. Hendrickson, Argyle, Wis.

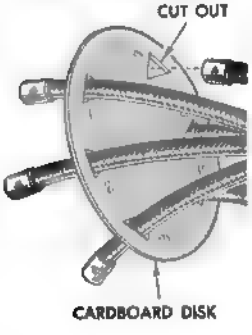
Offset Centering Attachment Permits Taper Turning



If the tailstock of your wood-turning lathe cannot be shifted laterally to permit taper turning, this auxiliary attachment provides an adjustable tail center. It fits in place of the regular tailstock center and has a movable center which can be offset to suit the taper desired. To make it, cut off the cup end of an extra Morse-taper center and weld it to a short length of threaded rod or a section of bolt. Next, weld the tapered part of the severed center to a U-shaped rod as shown in the detail. Then cut a slot in a piece of flat iron for the movable center and weld it to the U-shaped rod. Finally, weld two flat-iron legs to the assembly to rest on the lathe bed and support the centering attachment laterally in a horizontal position.

James McDonald, Johnsonburg, Pa.

Paper Disk Tags Ignition Wires When Removed From Distributor

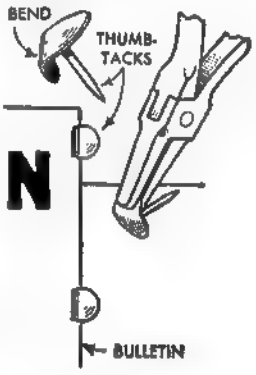


Unless ignition wires are numbered, it is very important when removing them from the distributor that they be tagged. Otherwise, you stand a good chance of fouling the firing order of the engine by forgetting where each wire goes when replacing it. To avoid this, one mechanic used a cardboard disk to tag the wires. Holes were made in it and numbered as shown, and as each wire was removed from the distributor, it was inserted in the corresponding hole in the disk. Held in this manner, there was no way of getting the wires mixed up.

Gene Holce, Seattle, Wash.

Thumbtacks Fasten Bulletins Without Perforating

By bending one side of the heads of thumbtacks with a pair of pliers as shown, they may be used to hold papers securely to bulletin boards without perforating them. Used in this way, the tacks need only be pried up slightly to remove the bulletins.



Metal Guard Protects Trouser Leg While Stringing Barbed Wire

A rectangular piece of galvanized iron bent to the curvature of your hip and thigh and extending from the waist to below the knee makes a good guard when stringing barbed wire. Holes are drilled in the top corners of the metal so that a cord can be passed through them and around the waist to hold the guard in place. Small stove bolts are spaced along the length of the guard to hold the wire at different heights. Holes may be drilled at the end of the guard to tie it to your leg.

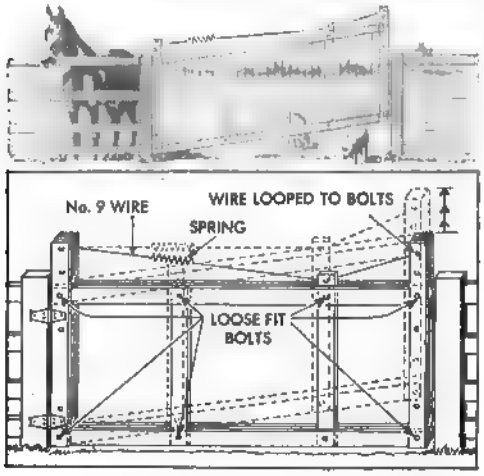
Homemade Orchard Sprayer Has Shielded Deck

By mounting a compressor and wooden sprayer tank on an old car chassis, one farmer built this orchard sprayer at ■ very reasonable cost. It will handle from two to four "broom" nozzles, depending on the size of the compressor used. The compressor is located between the motor of the car and the tank, and is operated by a dual V-belt drive. As the motor is used only to operate the compressor and tank agitator, the unit must be towed by a tractor or team. A canvas-shielded platform is erected over the compressor to enable the operators to reach the tops of tall trees. The canvas protects the men from wet branches when working in old orchards where the trees are close together. A cable-type control arranged on the platform will afford convenient operation of the motor from this position. The tank is filled through a trap door in the top, and an agitator inside keeps the spray mixture from precipitating. The agitator should be of the rotary type, driven from the motor by a V-belt and jackshaft. Spray hoses are connected to the outlets from the compressor and they should be long enough to enable the men to move about the orchard on foot or to stand on the platform. The dual rear wheels prevent the heavy unit from cutting in when used on soft ground.

A. M. Wettach, Mt. Pleasant, Ia.

Self-Raising Gate Elevates to Permit Passage of Small Animals

When this unusual stock gate is unlatched, the end automatically will rise several inches off the ground enabling it to clear rocks, snow and other obstacles when swung open. If provided with two latches, one mounted a distance above the other, the gate may be left closed and in the raised position to provide a creep for smaller animals while still confining the larger ones. It is constructed and strung with barbed wire as shown.



Rubber-Sheathed Drench Bottle

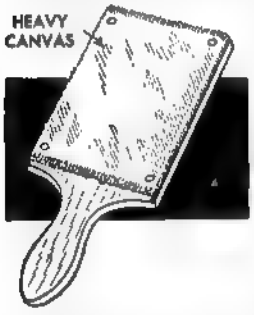
When drenching a sick cow or horse, the danger of the animal's breaking the neck of the bottle and swallowing a piece of glass is overcome by fitting the bottle with a rubber-hose extension as shown. This method simplifies drenching, as the hose is inserted in any part of the animal's mouth.

A. R. Stroda, Marion, Kans.

Worker Wears Checkered Cap To Indicate Deafness

In one shop, workers who have defective hearing wear special checkered caps. These serve as a warning to crane operators, truck drivers, etc., that a sound audible to most people cannot be heard by a worker wearing the cap. Other shop hands warn the hard-of-hearing person of the approach of cranes and trucks. Often it is possible to assign such a worker to a part of the shop where the traffic is not heavy.

Heavy Canvas Cleans Eraser



While cleaning the pencil smudges from a large drawing after inking, one draftsman found that he could clean his eraser thoroughly by rubbing it on a piece of heavy canvas. Obtain a small piece of canvas and mount it on a paddle board. This will hold the canvas taut and make it easy to locate when needed. If you wish, drill a hole in the handle to permit hanging.

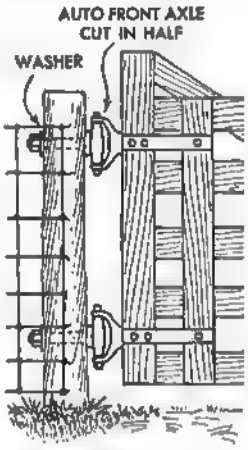
Francis A. Moore, Rochester, N. Y.

Sticks Made From Solder Scraps

Neat solder sticks can be made from scraps of solder by using a sheet of corrugated cardboard for molds. Each corrugation serves as a "mold" or tube for an individual stick. After the sheet has been cut so there are enough molds of the proper length, seal one end of each corrugation with putty and form a V-shaped trough at the other end for pouring the metal. This is done by spreading the flat part of the sheet and making a putty dam at each end. Pour the metal and, after it has cooled, remove the cardboard.

M. R. Thornburg, Whittier, Calif.

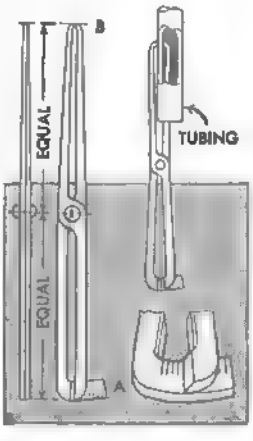
Car Axle Provides Gate Hinges



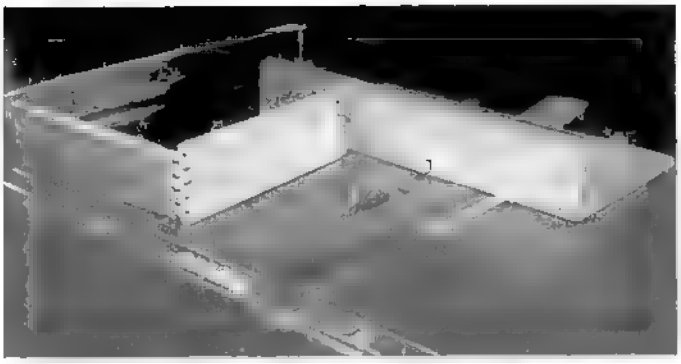
The front axle from an old car will make a strong and serviceable pair of hinges for a heavy farm gate. Cut the axle in half and drill three holes in each of the halves to bolt them firmly to the gate uprights. Either large washers or a piece of flat iron drilled with registering holes should be placed on the opposite side of the uprights to serve as a bearing plate for the nuts. Then, bore holes through the post to take the wheel spindles and fasten them in place rigidly with wheel nuts and washers.

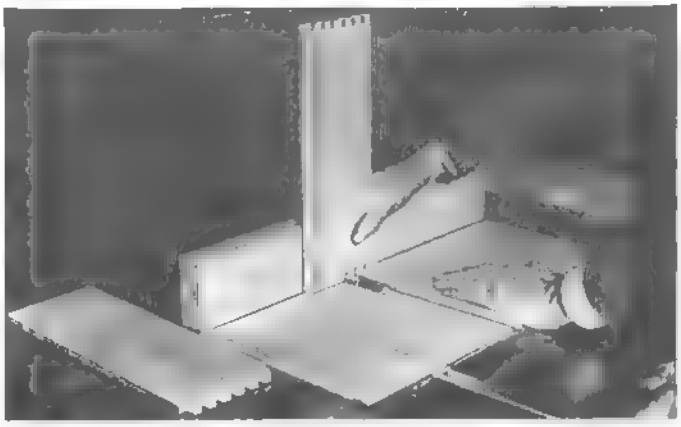
Outside Caliper Has Scale

With this outside caliper, the thickness of the walls of pipe and tubing may be measured several inches from the end, and the measurement noted while the caliper is still in position. A scale which gives a direct reading from the measuring points is mounted at the opposite end of the caliper. Distances from the pivot point to scale A, and the measuring points, B, must be exactly equal, as the slightest variation will give an inaccurate reading on the scale. The scale should read zero when the measuring points are in the closed position.



Matching Joints Cut With Saw Guide

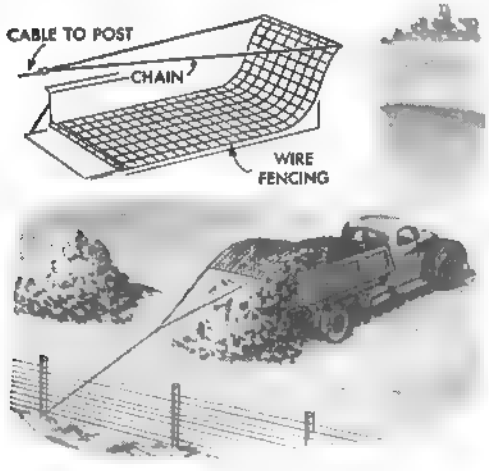




For a shop with limited woodworking facilities, this circular-saw guide or jig will aid in making open-end, mortise-and-tenon corner joints for boxes, chests and similar types of containers requiring matching corners. Although the dimensions of the guide will vary according to the size of box being made and the particular saw being used, the ones given are suitable for most work. The base is a ¼-in. plywood panel, 12 by 24 in. long and the crosspiece is a 2 by 4-in. board, 24 in. long. The crosspiece is screwed lengthwise to the panel, as indicated by the photographs, and two guide strips that slide in the saw-table grooves are fastened to the underside of the base. These strips should be about 18 in. long. The gauge strip, which fits into the corner formed by the crosspiece and the base, is the only other piece required, and its size and position are determined by the requirements of the job at hand. For example, assuming that you wish to make a box with ⅜-in. mortise-and-tenon corner joints, set the dado head for a ⅜-in. cut and saw through the crosspiece and base for a distance of 5 in. Trim the gauge strip to a width of ⅜ in. and fasten it exactly its own width from the right side of, and parallel with, the cut in the base. Then, to start the cuts on end pieces, hold them against the strip. Side pieces are started ⅜ in.—the width of a mortise or notch—to the left of the gauge strip. As each notch is cut, place it over the strip to cut the next one.

Wm. B. Swindells, Baltimore, Md.

Wire-Fencing "Unloader" Speeds Removal of Material From Flat-Bed Truck



Removing a load by hand from a flat-bed truck is slow and laborious work, but with this wire-fencing and chain arrangement, corn fodder, stovewood and other materials that will not slip through the mesh can be unloaded in short order. For finer materials, use ■ fine-mesh screen. The detail shows how the fencing is placed on the bed of the truck with one end fastened near the tail gate and the free end reinforced with a spreader made from a length of 2-in. pipe to which chains and a cable are attached. Load the truck in the ordinary manner, putting the load on top of the fencing. To unload, tie the cable to a post and drive the truck forward slowly, being careful not to tear the fencing from the tail gate. Carry a stake to anchor the cable in case a post is not near.

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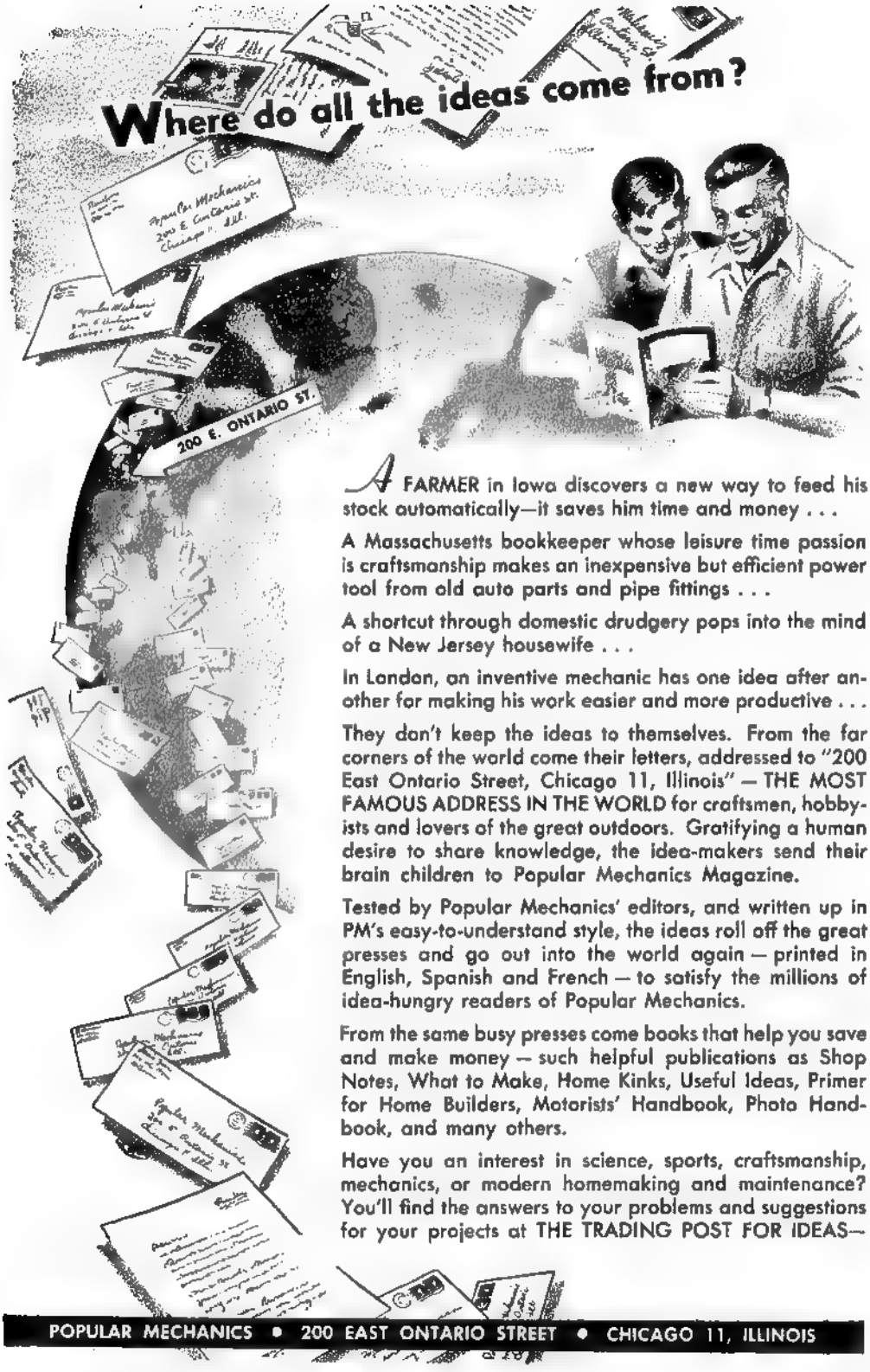

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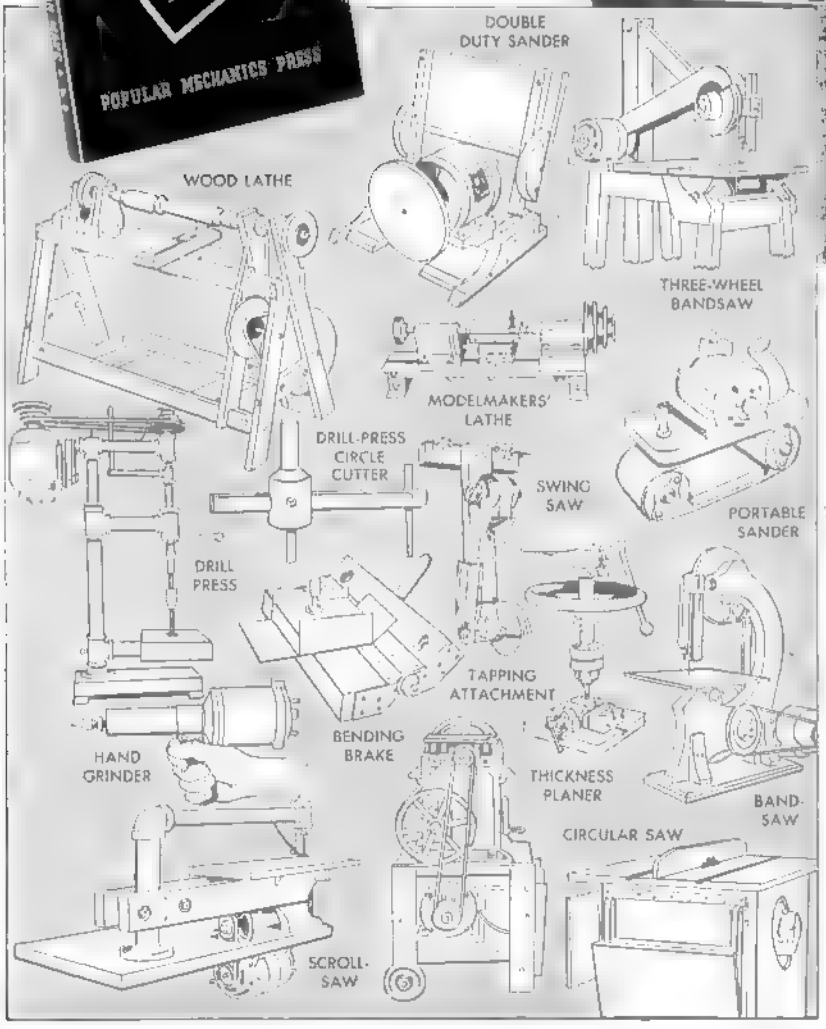

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